CONTRIBUTIONS TO THE MOSQUITO FAUNA OF SOUTHEAST ASIA. - XVI.

GENUS *AEDES* MEIGEN, SUBGENUS *AEDIMORPHUS* THEOBALD IN SOUTHEAST ASIA.[1, 2]

By

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ABSTRACT

This paper is a comprehensive revision of the *Aedes (Aedimorphus)* in Southeast Asia and deals with 14 species and 1 subspecies. These species are completely described and compared with closely related forms occurring in the Pacific Islands and Oriental Zoogeographical Regions. Pupae of *caecus, culicinus, mediolineatus, orbitae, pampangensis* and *pipersalatus*, larvae of *culicinus* and *orbitae* and the egg of *mediolineatus* are described for the first time. Stages and genitalia of the following species are also illustrated for the first time: *alboscutellatus* male; *caecus* female genitalia, male and pupa; *culicinus* female, female genitalia, male, pupa and larva; *lowisii* female genitalia; *mediolineatus* female genitalia, male, pupa and egg; *nigrostriatus* female, female genitalia and male; *orbitae* female, female genitalia, male, male genitalia, pupa and larva; *pallidostriatus* female and female genitalia; *pampangensis* female genitalia and pupa; *pipersalatus* female genitalia, male and pupa; *punctifemoris* female, female genitalia and male; *stenoetrus* female genitalia and male; and *taeniorhynchoides* female genitalia and male. Keys to the adults (including *stenoetrus* and *taeniorhynchoides*), pupae and larvae of Southeast Asian species are given.

New synonyms in this paper are: *lowisii (= mindoroensis)*; *pampangensis (= niveoscutellum)*; and *vexans (= nocturnus)*. Lectotypes for *lowisii, nigrostriatus, orbitae* and *pallidostriatus* and a neotype for *pampangensis* are designated. *Aedes stenoetrus* and *taeniorhynchoides* are excluded from the fauna of Southeast Asia.

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INTRODUCTION

The subgenus *Aedimorphus* was originally described by Theobald (1903a: 290) as a distinct genus based on a single African species, *domesticus* (Theobald). A number of Oriental species now included with *Aedimorphus* were at various times placed under other genera and subgenera. Felt (1904: 391c) erected a new genus, *Ecculex*, for the species *vexans* (Meigen) (= *sylvestris* Theobald). The following year, Ludlow (1905: 94) described a new genus *Reedomyia* for her new species *pampangensis*. During this same year, Theobald described 3 new genera: *Pecomyia* (1905a: 23) for *taeniorhynchoides* (= *maculata* Theobald), *Pseudograbhamia* (1905c: 243) for *pipersalatus* (= *maculata* Theobald), and *Lepidotomyia* (1905b: 80) for *alboscutellatus* Theobald. *Geitonomyia* was described by Leicester (1908: 134) for *caecus* (Theobald) and *Leslieomyia* by Christophers (1911: 68) for his new species *taeniorhynchoides*. Edwards (1913: 227) placed several of the Oriental species in the genus *Ochlerotatus* Lynch Arribalzaga but later (1922b: 466) transferred them to the genus *Aedes* Meigen subgenus *Ecculex*.

Two Oriental species, *alboscutellatus* and *vexans*, were moved by Edwards (1924: 372) to the subgenus *Aedimorphus* and the next year (1925: 267) he synonymized *Ecculex* with this subgenus. In the Genera Insectorum, Edwards (1932: 165) reviewed *Aedimorphus* from a worldwide standpoint and divided it into 8 groups. The first comprehensive study of the subgenus in the Oriental area was conducted by Barraud (1928: 655) and included the species occurring in India. He later (1934: 246) revised the Indian species. Knight and Hurlbut (1949: 29) and Knight and Hull (1951: 200) modified Edward's group classification of the *Aedimorphus* by combining Group D with Group C.

The present review deals with 14 species and 1 subspecies from Southeast Asia and compares them to closely related species in the Oriental and Pacific Islands Zoogeographical Regions. Pupae of *caecus*, *culicinus*, *mediolineatus*, *orbitae*, *pampangensis* and *pipersalatus*, larvae of *culicinus* and *orbitae* and egg of *mediolineatus* are described for the first time herein. Stages and genitalia of the following species are also illustrated for the first time: *alboscutellatus* male; *caecus* female genitalia, male and pupa; *culicinus* female, female genitalia, male, pupa and larva; *lowisii* female genitalia; *mediolineatus* female genitalia, male, pupa and egg; *nigrostriatus* female, female genitalia and male; *orbitae* female, female genitalia, male, male genitalia, pupa and larva; *pallidostriatus* female and female genitalia; *pampangensis* female genitalia and pupa; *pipersalatus* female genitalia, male and pupa; *punctifemoris* female, female genitalia and male; *stenoetrus* female genitalia and male; and *taeniorhynchoides* female genitalia and male. Keys to the adults (including *stenoetrus* and *taeniorhynchoides*), pupae and larvae of the Southeast Asian species are given. For original descriptions of the Oriental and Pacific Islands species not found in Southeast Asia see: Theobald (1905b: 86) *trimaculatus*; Theobald (1907: 395) *stenoetrus*; Christophers (1911: 68) *taeniorhynchoides*; Edwards (1914: 77) *jamesi*; Barraud (1928: 662) *syntheticus* (as *fisheri*); Stone (1939: 163) *oakleyi*; Carter and Wijesundara (1948: 139) *argenteoscutellatus*; Knight and Hurlbut (1949: 27) *senyavinensis*; Bohart (1956: 63) *trukensis*; and Reinert (1972b: 357 *gouldi*). For taxonomic information on the African species check Edwards (1941) and Hopkins (1952).

New synonyms in this paper are: *lowisii (= mindoroensis)*; *pampangensis (= niveoscutellum)*; and *vexans (= nocturnus)*. *Aedes stenoetrus* and *taeniorhynchoides* are excluded from the fauna of Southeast Asia.

During the course of this revision, I examed all specimens and types of *Aedimorphus* in the United States National Museum (Natural History) and the British Museum (Natural History) as well as specimens from numerous individual and museum collections. Lectotypes for *lowisii, nigrostriatus, orbitae* and *pallidostriatus* and a neotype for *pampangensis* are designated in this paper.

Abbreviations used in references to literature conform to the World List of Scientific Periodicals, 4th edition, Butterworths, Washington, 1963. In the synonymy sections, an asterisk following the abbreviations used (A = adult, ♀ = female, ♂= male, P = pupa, L = larva, E = egg) indicates that at least some portion of that sex or stage is figured. Abbreviations used in the pupal descriptions, illustrations, tables and key are: C = cephalothorax; P = paddle; and I-VIII = abdominal segments 1 through 8. In larval descriptions the range of hair branching is followed by the mode branching in parentheses and the following abbreviations signify: A = antenna; C = head; M = mesothorax; P = prothorax; S = siphon; T = metathorax; and VIII, X = abdominal segments 8 and 10. Abbreviations used in larval illustrations are as above with the following additions, CS = comb scale and PT = pecten tooth. When possible 10 specimens were used in determining the range and mode hair branching in pupal and larval descriptions. Measurement scales on the illustrations are in millimeters. Distribution records are indicated as follows: countries are in capital letters; where known, primary administrative divisions are in italics; and place names have the first letter capitalized. The spelling of Thai changwats and locality names is taken from the Official Standard Names Gazetteer No. 97 prepared by the Office of Geography, Department of the Interior, Washington, D.C., April 1966. Spelling of South Vietnam provinces and locality names is taken from the Official Standard Names Gazetteer No. 58, 2nd Edition, prepared by the Geographic Names Division, U.S. Army Topographic Command, Washington, D.C., May 1971. Locality names which do not appear in the gazetteers are spelled according to the labels on the specimens.

Information in the BIOLOGY section of each species is taken from the collection sheets and the labels attached to the specimens. Biological data recorded in the literature are also given and the sources are cited.

The nomenclature and chaetotaxy used for females, female genitalia, males and male genitalia follow Knight (1970), Knight and Laffoon (1970a, 1970b, 1971) and Laffoon and Knight (1971) and those for the adult wing venation, pupae and larvae follow Belkin (1962). The terminology of the egg is from Kalpage and Brust (1968). Female genitalia descriptions are based on 5 or more specimens except for a few species for which less material was available, therefore the ranges of variation could possibly exceed those recorded especially for *lowisii, nigrostriatus* and *pallidostriatus*. All measurements of the female genitalia were made on specimens that had been cleared, dissected, arranged in a flattened position and mounted in Canada balsam on microscope slides. Terga VIII and IX and sternum VIII measurements are taken from sclerotized areas. The following definitions and figure 70 explain new terms not described by Laffoon and Knight (1971).

Cercus index = Dorsal measurement of distance from apex to the most anterior point of base (dorsal cercus length) divided by measurement of width at 0.50 distance from apex (cercus width).

Cercus/dorsal PGL index = Dorsal cercus length divided by dorsal postgenital lobe length.

Dorsal postgenital lobe index (dorsal PGL index) = Dorsal measurement of distance from apex to midpoint of peri-anal membrane attachment (dorsal PGL length) divided by measurement of width at 0.50 length (dorsal PGL width).

Peri-anal membrane = Membrane attached to ventrobasal portion of cerci, extending around the anus and attached to the dorsal surface of the postgenital lobe, the latter point of attachment usually appears as an inverted "U".

Tergum IX index = Dorsal measurement of distance from apex to the most anterior point of base (tergum IX length) divided by measurement of width at widest point (tergum IX width).

Tergum VIII index = Dorsal measurement of distance from apex to most anterior point of base (tergum VIII length) divided by measurement of width at widest point (tergum VIII width).

Sternum VIII index = Ventral measurement of distance from apex to most anterior point of base (sternum VIII length) divided by measurement of width at widest point (sternum VIII width).

Ventral postgenital lobe index (ventral PGL index) = Ventral measurement of distance from apex to midpoint of posterior margin of the upper vaginal lip (ventral PGL length) divided by measurement of width at 0.50 of dorsal length (dorsal PGL width).

In the pupal descriptions, the number of branches on abdominal hair 1-I is counted on the basal 0.33 of the hair.

Southeast Asia, in this study, is composed of southern China, Bangladesh (East Pakistan), Assam, Burma, North Vietnam, South Vietnam, Taiwan, Philippines, Indonesia, Laos, Cambodia, Thailand, Malaysia, Singapore, Andaman and Nicobar Islands, Southern Ryukyus, Hainan and The Pescadores.

GENUS *AEDES* MEIGEN

SUBGENUS *AEDIMORPHUS* THEOBALD

Aedimorphus Theobald 1903, Monogr. Cul. 3: 290 (July).
Haplotype: *Uranotaenia domestica* Theobald.

Catageiomyia Theobald 1903, Mem. Lpool. Sch. trop. Med. 10 (App.): i (Nov.).
Haplotype: *Catageiomyia senegalensis* Theobald.

Ecculex Felt 1904, Bull. N.Y. St. Mus. 78: 391c. Orthotype: *Culex sylvestris* Theobald.

Reedomyia Ludlow 1905, Can. Ent. 37: 94. Haplotype: *Reedomyia pampangensis* Ludlow.

Lepidotomyia Theobald 1905, Ann. Mus. nat. Hist. Hung. 3: 80. Haplotype: *Lepidotomyia alboscutellata* Theobald.

Pecomyia Theobald 1905, J. econ. Biol. 1: 23. Haplotype: *Pecomyia maculata* Theobald.

Polyleptiomyia Theobald 1905, Genera Insec., Fasc. 26: 21. Haplotype: *Stegomyia albocephala* Theobald.

Pseudograbhamia Theobald 1905, J. Bombay nat. Hist. Soc. 16: 243. Haplotype: *Pseudograbhamia maculata* Theobald.

Duttonia Newstead 1907, *in* Newstead, Dutton and Todd, Ann. trop. Med. Parasit. 1: 17. Logotype: *Duttonia tarsalis* Newstead.

Mimeteculex Theobald 1908, Rep. Wellcome trop. Res. Lab. 3: 258. Haplotype: *Mimeteculex kingii* Theobald.

Geitonomyia Leicester 1908, Cul. Malaya, p. 134. Haplotype: *Culex caecus* Theobald.

Myxosquamus Theobald 1909, Colon. Rep. misc. Ser. No. 237: 7; Theobald 1910, Monogr. Cul. 5: 225. Haplotype: *Myxosquamus confusus* Theobald.

Stenoscutus Theobald 1909, Colon. Rep. misc. Ser. No. 237: 7; Theobald 1910, Monogr. Cul. 5: 263. Haplotype: *Stenoscutus africanus* Theobald.

Bathosomyia Theobald 1909, Colon. Rep. misc. Ser. No. 237: 9; Theobald 1910, Monogr. Cul. 5: 267. Haplotype: *Bathosomyia abnormalis* Theobald.

Neopecomyia Theobald 1909, Colon. Rep. misc. Ser. No. 237: 12; Theobald 1910, Monogr. Cul. 5: 261. Haplotype: *Neopecomyia uniannulata* Theobald.

Leslieomyia Christophers 1911, Paludism 2: 68. Haplotype: *Leslieomyia taeniorhynchoides* Christophers.

The following description of the subgenus applies to species from the Oriental and Pacific Islands areas.

FEMALE. *Head.* Antenna brown, 0.87-1.14 length of proboscis, pedicel usually pale with a patch of short fine hairs, scales or both mesally, flagellomere 1 pale with a few small scales; clypeus brown, bare; maxillary palpus 0.17-0.25 length of proboscis; proboscis usually brown with pale ventral markings, 0.98-1.33 length of femur I; eyes narrowly separated; interocular and ocular setae well developed; ocular line covered with narrow pale scales (*punctifemoris* has broad scales on this area); vertex with dorsum covered with narrow decumbent scales except in *punctifemoris* and *wainwrighti* which have dorsum covered with broad decumbent scales; numerous erect forked scales on occiput and vertex extending anteriorly to ocular line (vertex of *wainwrighti* without erect forked scales). *Thorax.* Scutum covered with narrow curved scales (*punctifemoris* also has small patches of broad white scales), arrangement and color of scale patterns varies with the species; scutellum with scales broad, narrow or both; median anterior promontory, acrostichal (absent in *wainwrighti*), anterior and posterior dorsocentral (few bristles present in *wainwrighti*), scutal fossal, supra-alar, posterior medial scutal, postalar callar, and median and lateral scutellar bristles well developed; antepronota widely separated with narrow curved scales (*culicinus, punctifemoris, vexans vexans, vexans nipponii* and *wainwrighti* have some broad scales) and several well developed bristles; postpronotum with narrow curved scales (*culicinus, vexans vexans* and *vexans nipponii* also have a few broad ones and *punctifemoris* has only broad scales) and 3-10 posterior bristles; propleuron with broad scales (*mediolineatus* and *pallidostriatus* have narrow scales) and numerous bristles; prosternum bare of scales and bristles except for members of the *vexans* group (*stenoetrus, syntheticus, vexans vexans* and *vexans nipponii*) which possess scales, also 1-3 bristles in the 2 subspecies of *vexans*; postspiracular area with or without broad or narrow scales and 3-11

bristles; subspiracular area with 1 or 2 patches of scales (*orbitae* has this area bare and *alboscutellatus*, *oakleyi*, *senyavinensis*, *trukensis* and *lowisii* have a patch of short fine hairs); mesepisternum with an upper and a posterior patch of broad scales and several upper and posterior bristles, lower ones shorter; prealar knob with several bristles and with or without scales; paratergite with scales (*lowisii* without scales); mesepimeron with a patch of broad scales and several bristles on upper area, lower area bare; other pleural areas bare. *Legs*. Coxae I-III each with several bristles and usually broad scales; trochanters I-III with broad scales; femora I-III with various scale patterns but usually each with a white dorsoapical spot, III usually with most of anterior surface pale scaled; tibiae I-III with various scale patterns; tarsi I-III with basal pale bands, dorsobasal pale spots or without ornamentation (*lowisii* also has apical pale scales on tarsomeres); posttarsi I-III each with 2 ungues, I, II with ungues equal in size and each bearing a tooth and III with ungues equal in size and simple (III toothed in *pampangensis* and toothed or simple in *stenoetrus* and *vexans*). *Wing*. Dorsal veins usually covered with moderately broad brown scales with a small pale patch at base of costa, a few species with pale scales intermixed; alula with narrow scales along fringe; remigium with 1-4 bristles, usually 2. *Abdomen*. Tergum I with a rectangular patch of pale scales on laterotergite; terga with or without basal pale bands and usually with lateral pale spots; sterna usually pale scaled with some brown markings; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia*. The following is a composite description of the Southeast Asian species. Tergum VIII medium sized, trapezoid-shaped with base somewhat indented or with apex broadly rounded, bristles scattered over entire surface, none to 3 small scales, 0.60-1.00 retracted into segment VII (except *caecus* which is only 0.30-0.50 retracted), index 0.73-1.44; sternum VIII large, heart-shaped with a deep median apical indentation, short and a few long bristles scattered over entire surface but most numerous apically, none to 3 small scales, index 0.78-1.11; tergum IX with moderately pigmented lateral portions, bilobed with 3-14 bristles on each lobe, index 0.78-1.58; insula tongue-like, covered with minute setae and with 3-7 small tuberculi on apical 0.25 (except *vexans vexans* and *vexans nipponii* which lack tuberculi); lower vaginal lip narrow, semicircular shaped, moderately pigmented (occasionally heavily pigmented in *mediolineatus*), covered with minute setae; upper vaginal lip narrow, heavily or occasionally moderately pigmented, covered with minute setae, semicircular shaped with caudal margin flat; upper vaginal sclerite large, moderate to heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation (except *pallidostriatus* which has a small one and *orbitae* with a deep one), 3-10 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.70-1.48, ventral PGL index 1.52-3.29; cercus moderately long to long, apex sharply rounded, numerous short and moderately long bristles scattered over dorsal and lateral surfaces and a few long ones apically, completely covered with minute setae, index 2.08-4.27, cercus/dorsal PGL index 2.55-5.22; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones (except in *alboscutellatus*, *culicinus*, *lowisii* and the other Oriental members of the group *jamesi*, *oakleyi*, *senyavinensis* and *trukensis* which have 1 large one and 2 tiny rudimentary ones).

MALE. Similar to female in general habitus. *Head*. Antenna plumose with hairs directed mainly dorsally and ventrally; maxillary palpus with apical 2 segments short and down-turned with numerous apical and ventrolateral bristles, antepenultimate segment with apical portion somewhat swollen

and with several ventrolateral bristles, longer than proboscis by 0.50 to 1.00 length of apical segment. *Thorax*. Prosternum bare including members of the *vexans* group. *Legs*. Posttarsi I-III each with 2 ungues, I, II with ungues unequal in size and each bearing a tooth, III with ungues equal or unequal in size and simple (toothed in *stenoetrus*). *Genitalia*. Tergum IX bilobed with 3-11 bristles on each lobe, entire surface covered with minute spicules; gonocoxite moderately long to long and moderately broad, dorsal surface usually covered with scattered short bristles with longer ones at apex, lateral margin with long stout bristles from base to apex, ventral surface usually with long stout bristles on distal 0.50, scattered scales on lateral and ventral surfaces; gonostylus usually complex with apical portion expanded into a mesal lobe and a lateral horn-like structure (gonostylus blade-like in *stenoetrus, syntheticus, vexans vexans* and *vexans nipponii*), gonostylar claw attached mesally near middle and with 1 or more accessory claws at apex; basal mesal lobe with 3-38 bristles (*stenoetrus* has 118-128 bristles) and covered with short hair-like spicules; proctiger short to long, paraproct smooth and bluntly pointed or slender with a rounded apex and a subapical thumb-like process, cercal setae absent; phallosome with aedeagus with 2 lateral plates connected basally, each plate with 4-9 teeth and covered by a dorsal flap, paramere long; parameral apodeme broad basally and tapering into a long narrow distal arm; sternum IX large with the entire surface covered with minute spicules and 2-15 bristles near center.

The genitalia of the Oriental species are divided into 2 types based on characteristics of the phallosome and proctiger. Type I (Figs. 33, 34) has the aedeagus divided into 2 lateral plates connected basally, each plate bears 4-7 short blunt lateral teeth on distal 0.50 and is covered with a pigmented dorsal flap which is narrow distally and broadly rounded proximally (when aedeagus is dissected the teeth pull away from the lateral plate and remain attached to the dorsal flap). The proctiger is short and the paraproct is distally slender and apically rounded with a subapical thumb-like process. The majority of the Oriental species have type I genitalia. Type II (Figs. 33, 47) has the aedeagus divided into 2 lateral plates connected basally, each plate bears 5-9 short to moderately long, longitudinal lateral teeth with tergally curved apices and is covered with a pigmented dorsal flap which is narrow distally and tapers to a broad base. The proctiger is long and the paraproct is narrow with a bluntly pointed apex.

PUPA. The pupae of the species that occur in Southeast Asia do not, at this time, present any clear-cut subgeneric characters. The pupal chaetotaxy is summarized as follows: *Cephalothorax*. Hairs 1, 2-C with 2-8 branches; 3-C with 2-5 branches; 4-C single to 9 branched; 5-C single to 8 branched; 6, 9-C single to 4 branched; 7-C with 2-11 branches; 8-C with 2-9 branches. *Metanotum*. Hair 10-C with 4-33 branches; 11-C single; 12-C single to 11 branched. *Abdomen*. Hairs 0-II-VIII single; 1-I with 16-46 branches on basal 0.33, 1-II with 3-49 branches, 1-III with 3-18 branches, 1-IV with 2-13 branches, 1-V single to 10 branched, 1-VI single to 13 branched, 1-VII single to 10 branched; 2-I-VII single or double; 3-I-III single to triple, 3-IV with 2-12 branches, 3-V single to 5 branched, 3-VI single to 8 branched, 3-VII with 2-16 branches; 4-I with 2-7 branches, 4-II with 2-16 branches, 4-III, VIII single to 8 branched, 4-IV single to 4 branched, 4-V single to 14 branched, 4-VI single to 11 branched, 4-VII single to 10 branched; 5-I with 2-18 branches, 5-II with 2-14 branches, 5-III with 2-13 branches, 5-IV, V single to 5 branched, 5-VI single to 6 branched, 5-VII single to 9 branched; 6-I single to triple, 6-II single to 5 branched, 6-III-VI single to 8 branched, 6-VII with 3-14 branches;

7-I, IV single to 6 branched, 7-II single to 10 branched, 7-III with 2-9 branches, 7-V single to 11 branched, 7-VI single to 4 branched, 7-VII single to 5 branched; 8-III, VII single to 7 branched, 8-IV-VI single to 5 branched; 9-I-VI single, 9-VII with 2-11 branches, 9-VIII with 4-14 branches; 10-III single to 6 branched, 10-IV, VII single to 5 branched, 10-V single to 4 branched, 10-VI single to triple; 11-III-V single, 11-VI single or double, 11-VII single to 4 branched; 14-III-VIII single. *Paddle*. Hair 1-P single to triple and short. The respiratory trumpet is moderately broad and usually moderately pigmented. The paddle is ovoid, with tiny to minute serrations along the basal 0.50 of outer margin, usually with tiny spicules along apical margin, and the midrib does not reach the apex.

LARVA. The larval chaetotaxy and features of the Southeast Asian species are summarized as follows: *Head*. Hairs 1, 3-C single; 4-C small with 2-13 branches, usually with 5-7 branches; 5-C long, single to 9 branched, usually with 4-7 branches; 6-C long, single to 9 branched, usually with 4-6 branches; 7-C long with 4-16 branches, usually with 6-10 branches; 8, 9-C single to 6 branched, usually with 2-4 branches; 10-C single to 4 branched, usually double or triple; 11-C with 2-10 branches, usually with 3-6 branches; 12-C with 3-10 branches, usually with 3-6 branches; 13-C single to 9 branched, usually with 2-4 branches; 14-C single or double, usually single; 15-C single to 7 branched, usually with 2-5 branches; basal maxillary hair single; mental plate with 22-36 teeth. *Antenna*. Usually moderately pigmented, slightly incurved distally, usually numerous short stout spicules on shaft; hair 1-A long with 3-16 branches, usually with 5-10 branches, inserted at 0.36-0.52 from base; 2-A long; 3-A approximately equal to or about 0.50 length of 2-A. *Thorax*. Hair 0-P with 3-21 branches, usually with 5-10 branches; 1, 5, 6-P single; 2, 3, 9, 11-P single to 4 branched, usually double or triple; 4, 8-P single to 7 branched, usually double or triple; 7-P with 2-4 branches, usually double or triple; 10, 12-P single or double, usually single; 14-P single to triple, usually single or double; 1-M single to 8 branched, usually with 3-5 branches; 2-M single to 5 branched, usually with 2-4 branches; 3-M single to 5 branched, usually single to triple; 4-M with 2-9 branches, usually with 3-4 branches; 5-M single to triple, usually single; 6-M with 3-10 branches, usually with 4-6 branches; 7, 10, 12-M single; 8-M with 3-10 branches, usually with 5-8 branches; 9-M with 3-10 branches, usually with 6-9 branches; 11-M single or double, usually single; 13-M with 3-12 branches, usually with 5-8 branches; 14-M with 4-11 branches, usually with 5-8 branches; 1-T single to 4 branched, usually single or double; 2-T with 2-13 branches, usually with 3-6 branches; 3-T with 2-28 branches, usually with 6-10 branches; 4-T with 2-6 branches, usually with 3-4 branches; 5, 10-T single; 6-T single to 5 branched, usually single to triple; 7-T with 5-14 branches, usually with 6-10 branches; 8-T with 3-12 branches, usually with 4-7 branches; 9-T with 2-9 branches, usually with 4-6 branches; 11-T single or double, usually single; 12-T single to triple, usually single or double; 13-T with 4-19 branches, usually with 5-9 branches. *Abdomen*. Hairs 0, 14-VIII single; 1-VIII with 3-12 branches, usually with 4-9 branches; 2-VIII single to 5 branched, usually double or triple; 3-VIII with 5-27 branches, usually with 6-12 branches; 4-VIII single to 4 branched, usually double or triple; 5-VIII with 4-10 branches, usually with 4-7 branches; comb of 7-32 scales, usually arranged in 2 irregular rows; 1-X single to 4 branched, usually single to triple; 2-X with 5-15 branches, usually with 8-12 branches; 3-X single; ventral brush varies from 8 hairs on grid and 4 precratal ones to 14 hairs on grid and 3 precratal ones, some hairs always with 10 or more branches; saddle usually moderately pigmented with small spicules along

posterior margin, incompletely rings segment X, acus present or absent; 4 anal papillae usually moderately long to long and slender. *Siphon*. Usually moderately pigmented; acus usually present; index 2.11-9.00; pecten with 10-23 teeth, distal 2-4 teeth smooth and wider spaced than remainder which have a slender apical attenuated filament with 1-4 lateral denticles; hair 1-S with 3-7 branches, usually with 4-6 branches, inserted at 0.54-0.85 from base.

EGG. The eggs of only 3 species, *domesticus, mediolineatus* and *vexans* are known in the subgenus *Aedimorphus*. Eggs of *domesticus* are described by Reinert (1972a: 60), of *vexans* by Horsfall and Craig (1956: 370), Myers (1967: 796) and Kalpage and Brust (1968: 711-712) and of *mediolineatus* in this paper. A summary of the egg characters follows: *Shape*. Fusiform to spindle shaped. *Size*. In microns, *domesticus* 855-885 by 242-255, *mediolineatus* 735-840 by 190-200 and *vexans* 614-756 by 167-224. *Color*. Brown or bronze. *Chorion*. The surface reticulation of *domesticus* and *vexans* is similar and consists of a pattern of axially arranged cells, hexagonal and polygonal in shape and 3-6 *(domesticus)* or 2.5-5 *(vexans)* times as long as wide with cell walls raised. *Aedes mediolineatus* differs from *domesticus* and *vexans* and has a reticulation composed of polygonal cells of varied size with cell walls raised.

DISTRIBUTION. Species of *Aedimorphus* are confined to the Ethiopian, Oriental, Pacific Islands and northern portion of the Australian Zoogeographical Regions with the exceptions of *vexans vexans* which has a wide distribution and is found in the Holarctic, Oriental, Pacific Islands and Australian Zoogeographical Regions and *vexans nipponii* which is confined to the eastern part of the Palearctic Zoogeographical Region.

Eighty-two species and 5 subspecies (Table 16) of *Aedimorphus* are endemic to the Ethiopian Zoogeographical Region. This area contains the largest number of species and shares only *vexans vexans* with other regions. The Oriental Zoogeographical Region possesses 21 species (Table 11) and shares 5 (Table 12) of these with the Australian, 2 (Table 13) with the Palearctic, 3 (Table 14) with the Pacific Islands and 1 (Table 15) with the Nearctic Zoogeographical Regions.

Species of *Aedimorphus* have been collected from each of the countries in the Oriental and Ethiopian Zoogeographical Regions.

TAXONOMIC DISCUSSION. The subgenus *Aedimorphus*, in the Oriental Region, possesses a combination of characters that allows it to be separated from the other subgenera of *Aedes*. The most distinctive features are exhibited by the male, these being: antenna with the plume hairs directed mainly dorsally and ventrally; maxillary palpus with the 2 apical segments short and down-turned with numerous apical and ventrolateral bristles, antepenultimate segment with apical 0.25 somewhat swollen and with several ventrolateral bristles and longer than proboscis by 0.50 to 1.00 length of apical segment; genitalia with gonostylus complex and usually expanded distally with 1 or more gonostylar claws, proctiger short to long, paraproct smooth and bluntly pointed or slender with apex rounded and a subapical thumb-like process, cercal setae absent (present in some African species) and the phallosome which has the aedeagus composed of 2 lateral pigmented plates connected basally, each plate with 4-7 short blunt lateral teeth on distal 0.50 or 5-9 short to moderately long, longitudinal lateral teeth with tergally curved apices (*vexans* and its allies) and covered with a pigmented dorsal flap; and tarsomere 5 of tarsus I ventrally concaved with the base projecting posteroventrally into a protuberance with 3-4 short stout curved spines at apex and a pair of short bristles each arising from a conical tubercle located near the middle of the

ventral margin. A similar maxillary palpus is also found in *Ochlerotatus*, some *Finlaya* Theobald and *Chaetocruiomyia* Theobald while the antenna is typical of *Diceromyia*, *Stegomyia* Theobald, *Ochlerotatus* and some *Finlaya*. The toothed aedeagus of the *vexans* group is also similar to *Diceromyia* and some *Stegomyia* but is easily separated from the latter by the presence of the dorsal flap and from the former by the flap being pigmented and semirigid while in *Diceromyia* it is unpigmented or lightly pigmented and membranous (for a discussion of the *Diceromyia* see Reinert 1970). Males of *Aedes (Ayurakitia)* Thurman and *Udaya* Thurman have a pigmented dorsal flap over a toothed aedeagus which is similar in structure to *vexans*. *Ayurakitia* is separated from *Aedimorphus* by the absence of postspiracular bristles in the former. *Udaya* differs from *Aedimorphus* by the absence of acrostichal bristles. The tarsomere 5 of *Aedimorphus* resembles those of the tarsi I of *Psorophora* Robineau-Desvoidy, *Culex* Linnaeus and several other subgenera of *Aedes*. *Aedimorphus* males are easily separated from *Ochlerotatus*, *Finlaya* and *Chaetocruiomyia* by the structure of the aedeagus which is simple and non-toothed in the latter 3 subgenera. The maxillary palpus of *Stegomyia* is slender with the apical 2 segments upturned and is markedly different from *Aedimorphus*.

Other important characteristics of both sexes of the adults are: vertex with narrow curved decumbent scales medially (*punctifemoris* and *wainwrighti* with vertex covered with broad decumbent scales); erect forked scales numerous on occiput and vertex extending anteriorly to ocular line (these scales restricted to occiput in *wainwrighti*); female maxillary palpus short, 0.17-0.33 length of proboscis; acrostichal and dorsocentral bristles well developed and numerous (acrostichals absent and dorsocentral bristles few in *wainwrighti*); scutum covered with narrow curved scales (a few small patches of broad scales in *punctifemoris*); antepronotum and postpronotum usually with narrow curved scales; scutellum with narrow, broad or both types of scales; propleuron with numerous bristles; several upper bristles on mesepisternum; and lower mesepimeron without bristles or scales.

The females have the following features: genitalia with tergum VIII mostly or completely retracted into segment VII, sternum VIII with a deep median apical indentation and heart-shaped, cerci moderately long to long, narrow, extended from segment VII and visible dorsally, postgenital lobe with a median apical indentation, insula tongue-like, covered with minute setae and with 3-7 small tuberculi on apical 0.25, 3 seminal capsules approximately equal in size except for the *alboscutellatus* group which has 1 large and 2 rudimentary seminal capsules; and posttarsi of legs I-II with ungues each toothed and ungues of III usually simple. *Ochlerotatus* has similar cerci but can be easily separated by the presence of bristles on the insula. The female genitalia of *Aedes (Neomelaniconion) lineatopennis* (Ludlow) are very close to those of *Aedimorphus*. The insula of *Aedimorphus* resembles those of *Stegomyia* and *Diceromyia* but the cerci of the latter 2 species are short and broad. Female specimens usually can be separated from those of the other subgenera of *Aedes* by a combination of the characters mentioned.

For a long time, *Aedes nummatus* had been considered as an aberrant *Aedimorphus*. It possesses some features of *Aedimorphus* but contains a greater number of important characters of *Diceromyia*, notably features of the male maxillary palpus, male genitalia and female genitalia. It is therefore being transferred, along with a closely related new species, to the subgenus *Diceromyia* (Reinert *in press*).

The pupae of the Oriental species of *Aedimorphus* are very similar, especially in the chaetotaxy, shape of the respiratory trumpet and structure of

the paddle.

Aedimorphus larvae have a number of features, when used in combination, that allow them to be separated from the other Oriental subgenera of *Aedes* such as: antenna moderately long to long, slightly incurved distally and with numerous short, stout spicules on shaft, hair 1-A long, barbed with 3-16 branches; head hair 4-C always small and multiple branched, closer to 5-C than to 6-C and 5, 6-C long, barbed, usually close together and forming a diagonal line with 7-C (except in *vexans* and its allies which have 6-C anterior to 5,7-C and 4-C approximately equal distance from both 5, 6-C but slightly closer to 6-C; *vexans* head hair arrangement and other larval features are similar to many *Ochlerotatus*); siphon usually long with distal 2-4 pecten teeth usually smooth and always wider spaced than remainder which have a slender apical attenuated filament with 1-4 lateral denticles, pecten teeth on basal 0.50 of siphon except in *syntheticus* and hair 1-S multiple branched, usually small, inserted on distal 0.45, always distal to last pecten tooth; ventral brush of abdominal segment X varies from 8 hairs on grid and 4 precratal ones to 14 hairs on grid and 3 precratal ones, hairs of ventral brush each with 8-18 branches except *vexans nipponii* which have 4-12 branched hairs, some hairs always with 10 or more branches; and siphon usually with an acus.

The larvae of *Aedes* subgenera *Ochlerotatus*, *Neomacleaya* Theobald, *Verrallina* Theobald, *Edwardsaedes* Belkin and *Levua* Stone and Bohart are very similar to *Aedimorphus* but can be separated by the following characters: *Ochlerotatus* has head hair 4-C usually closer to 6-C than to 5-C and siphon hair 1-S usually inserted within distal portion of pecten (*vexans* group is similar in head hair arrangement); *Neomacleaya* and *Verrallina* have head hairs 4-C anterior to 5, 6-C and usually closer to 6-C than to 5-C, pecten usually extends past middle of siphon, or with siphon hair 1-S inserted within pecten; *Edwardsaedes* has saddle completely ringing segment X and precratal hair tufts inserted into ventral margin (similar to genus *Psorophora*), head hair 4-C well anterior to 5, 6-C, thorax with mesopleural and metapleural tubercles well developed with stout points; and *Levua* by the shape of the comb scales and the very small anal papillae. The larva of *Aedes (Neomelaniconion) lineatopennis* (Ludlow) is very similar to *Aedimorphus* (especially *vexans* group) and I cannot find any apparent subgeneric differences between them. The aberrant *Aedes (Stegomyia) vittatus* (Bigot) bears a resemblance to *Aedimorphus* larvae but differs in having the antenna with only a very few tiny spicules, head hair 4-C closer to 6-C than to 5-C, pecten extending beyond basal 0.50 of siphon, and siphon hair 1-S inserted within apical portion of pecten. The larvae of *Aedimorphus* differ from those of most of the other *Aedes* subgenera in the position and development of the head hairs, development of the antenna, possession of precratal tufts on segment X, number of hairs in ventral brush on segment X, number of branches on hairs of ventral brush, and development of the pecten and siphon.

MEDICAL IMPORTANCE. A number of species in the subgenus *Aedimorphus* have been implicated in the transmission of human and animal pathogens, primarily on the basis of recovery of disease agents from field-caught adult mosquitoes. The bulk of these agents have been arboviruses, where isolations have been reported from Africa, Europe, Asia and North America. In most instances, however, comprehensive data on other biological factors which determine vector status are not available.

Aedes vexans has been studied widely as a possible arbovirus vector. This species has many attributes of an ideal vector -- it is widely distributed, can become very abundant at times, often at the time virus activity is at a peak,

it feeds readily on man and domestic animals, and it has been found naturally infected with various arboviruses.

Aedes vexans vexans has been found infected in nature with western equine encephalitis (WEE) in Saskatchewan, Canada (McLintock et al. 1970: 448) and in the United States (Burroughs and Burroughs 1954: 33; Hayes et al. 1971: 184). It has also been found infected with eastern equine encephalitis (EEE) in the United States (Wallis et al. 1960: 442). Chamberlain et al. (1954: 281-283), however, found that *vexans vexans* had a relatively low infection and transmission rate for both these viruses, and consequently rated its vector potential for WEE and EEE as "fair". It is unlikely that this species, which is primarily a mammal feeder (Edman and Downe 1964: 156), would be much involved in the endemic maintenance of these viruses, which normally infect birds. As pointed out by Hayes et al. (1962: 119), *vexans vexans* may serve as an epidemic or epizootic vector during periods of abnormally high mosquito and virus activity.

A more likely vector role for the species is with the California encephalitis (CE) group viruses which naturally infect mammals. Sudia et al. (1971: 591) list the following CE group virus isolations from *vexans vexans* in North America: keystone, trivittatus, La Crosse, Jamestown Canyon, snowshoe hare and California. Nothing is presently known concerning the relative susceptibility of *vexans vexans* to these agents.

Experimental transmission of fowl pox virus to chickens by *vexans vexans* was demonstrated by Matheson et al. (1931: 218); and Hu (1931: 628) and Yen (1938: 193) showed experimentally that this species was a fairly good carrier of *Dirofilaria immitis* Leidy. Furthermore, Harinasuta et al. (1970: 242) found *vexans vexans* and *caecus* positive with stage III larvae of *Dirofilaria*. Aspock (1965: 767) and Mattingly (1969: 79) report that *vexans vexans* is involved in the transmission of Tahyna virus in central Europe. This virus was also isolated from *vexans vexans* in northern Italy by Balducci et al. (1968: 457).

Aedes vexans nipponii was suspected of being a vector of Japanese encephalitis virus (JE) in Japan by LaCasse and Yamaguti (1948: 104) and Hodes (1946: 358), working in Okinawa, experimentally transmitted this virus to mice by the bite of *vexans nipponii*. Studies by Barnett (1962: 344; 406th Medical General Laboratory Annual Progress Reports for 1949-51) in Japan, showed no instances of natural infection of the species out of thousands tested, many of which were collected during periods of peak virus activity. Shichijo et al. (1970: 91), however, report the isolation of 4 strains of Japanese encephalitis virus and 3 strains of group A arbovirus from this species in the Nagasaki area of Japan from 1965 to 1968. Sagiyama virus was isolated twice from *vexans nipponii*, once in Japan (Scherer et al. 1962: 261) and once in Okinawa (Hurlbut and Nibley 1964: 79).

This species of mosquito is not believed to be a vector of *Wuchereria bancrofti* Cobbold since the larvae of this parasite died in the body cavity of the mosquito according to Yamada (1927) and Newton et al. (1945: 256).

Although species of the subgenus are not known to be involved in yellow fever transmission, Bauer (1928: 267), working in Africa, experimentally transmitted this virus to monkeys by the bite of *stokesi* Evans (recorded as *apicoannulatus* Edwards).

Little is known about the actual role of members of the subgenus as vectors of other pathogens, and inferences must be based on reports of collections of naturally infected adult mosquitoes. In Thailand, Batai virus was isolated from a pool of 11 female *vexans vexans* and Wesselsbron virus from a pool of *mediolineatus* (SEATO Medical Research Laboratory Annual Progress Report for 1968: 63, 71).

In Africa, Middelburg virus has been isolated from the following species of *Aedimorphus: albocephalus* (Theobald) (Worth et al. 1961: 588), *marshalli* (Theobald) (Paterson et al. 1964: 188), *dentatus* (Theobald), *leesoni* Edwards and *cumminsii* (Theobald) (Robin et al. 1969: 113). The vector of this virus in Senegal seems to be *cumminsii* and sheep apparently play a part in the maintenance of the virus (Robin et al. 1969: 117). The latter authors found the virus primarily in cattle and rarely in man.

Smithburn and Haddow (1944: 265), while working in Africa, isolated Semliki Forest virus from naturally infected members of the *abnormalis* Theobald group. Sindbis, Middelburg and Shokwe viruses were isolated from *cumminsii* in the Republic of South Africa (Paterson et al. 1964: 188, McIntosh et al. 1972: 158). In Mozambique, Worth and de Meillon (1960: 241) and McIntosh et al. (1961: 193) report isolation of Semliki Forest virus from *argenteopunctatus* (Theobald).

Spondweni virus was isolated from *cumminsii* (Theobald) in the Republic of South Africa by McIntosh et al. (1961: 647). This virus was also isolated in Mozambique by McIntosh et al. (1962: 685) from a pool of 42 mosquitoes identified as *Aedes (Ochlerotatus) fryeri* (Theobald) or *Aedes (Aedimorphus) fowleri* (d'Emmerez de Charmoy). Worth et al. (1961: 588), in Republic of South Africa, also isolated Spondweni virus from *cumminsii*, Wesselsbron virus from *minutus* (Theobald) and an unidentified virus from *marshalli*. Rift Valley fever virus was isolated from a pooled sample of 50 percent *albocephalus* and 50 percent *tarsalis* (Newstead) in Africa by Smithburn et al. (1948: 117). Leeson (1958: 22, 26) also reports that *albocephalus* was found naturally infected with the virus of Rift Valley fever and that *tarsalis* is a vector of this virus. Rift Valley fever virus was isolated by B. M. McIntosh (personal communication 1972) from *dentatus* during an epizootic in cattle in Rhodesia in 1969. The African Bunyamwera virus was found in a pooled sample containing 5 subgenera of *Aedes* (8 species of *Aedimorphus*) by Smithburn et al. (1946: 190).

Aslamkhan and Wolfe (1971: 31), working in Bangladesh (East Pakistan), isolated unidentified filarial worms from *pallidostriatus* and found filarial larvae-like structures in the head muscles of *caecus* that had been taken in a human biting collection. Filaria larvae of *Brugia malayi* (Brug) were found in *pallidostriatus* and *pipersalatus* in Ceylon by Carter (1948: 313).

BIOLOGY. Females of many species of *Aedimorphus* readily feed on man and at times may be very serious pests. Other species prefer feeding on cattle and other animals and only occasionally bite humans. See the BIOLOGY section for the feeding habits of each species.

The typical immature habitats of *Aedimorphus* species in the Oriental Region are temporary and semipermanent fresh water ground pools. Some species have been collected from other habitats such as artificial containers, rockholes, and similar habitats, but usually only when their normal breeding places had dried up.

The eggs of *Aedes vexans* are drought-and cold-resistant and have remained viable for over 4 years. The egg biology of other species in the subgenus is not known.

LIST OF SPECIES OCCURRING IN SOUTHEAST ASIA

1. *Aedes (Aedimorphus) alboscutellatus* (Theobald)
2. *Aedes (Aedimorphus) caecus* (Theobald)
3. *Aedes (Aedimorphus) culicinus* Edwards
4. *Aedes (Aedimorphus) davidi* Basio

5. *Aedes (Aedimorphus) lowisii* (Theobald)
6. *Aedes (Aedimorphus) mediolineatus* (Theobald)
7. *Aedes (Aedimorphus) nigrostriatus* (Barraud)
8. *Aedes (Aedimorphus) orbitae* Edwards
9. *Aedes (Aedimorphus) pallidostriatus* (Theobald)
10. *Aedes (Aedimorphus) pampangensis* (Ludlow)
11. *Aedes (Aedimorphus) pipersalatus* (Giles)
12. *Aedes (Aedimorphus) punctifemoris* (Ludlow)
13. *Aedes (Aedimorphus) vexans vexans* (Meigen)
14. *Aedes (Aedimorphus) vexans nipponii* (Theobald)
15. *Aedes (Aedimorphus ?) wainwrighti* Baisas

KEYS TO THE SPECIES OF *AEDES (AEDIMORPHUS)* IN SOUTHEAST ASIA*

KEY TO THE ADULTS

1. Head with only broad scales on vertex; antepronotum with broad silvery scales. 2
   Head with narrow scales mesally on vertex; antepronotum with narrow curved white or golden scales, or if broad scales present these are not silvery. 3

2(1). Vertex of head with erect forked scales; postpronotum with a few broad silvery scales; tarsi dark. . . . . *punctifemoris*
   Vertex of head without erect forked scales; postpronotum without scales; tarsi with white bands. . . . . *wainwrighti*

3(1). Tarsi II, III with basal white bands or dorsobasal white spots. . . . 4
   Tarsi II, III without basal white bands or spots (some species may have lateral longitudinal white stripes). 12

4(3). Wing with dorsal veins brown scaled or with only a small spot of white scales at base of costa; femora I, II with anterior brown. . 5
   Wing with dorsal veins with white and brown scales intermixed or with a number of white scales on posterior margin and base of costa; femora I, II with a large number of white scales intermixed with brown ones. 7

5(4). Scutellum with broad and narrow white scales on each lobe; tarsus III with a narrow basal white band on tarsomere 5. . . . . *caecus*
   Scutellum with broad silvery scales on each lobe; tarsus III with tarsomere 5 pale scaled. 6

*_Aedes stenoetrus_ and _taeniorhynchoides_ are not found in Southeast Asia but are included in order to prevent them from being confused with closely related species.

6(5). Maxillary palpus brown scaled; tarsi I, II each with tarsomere 5 pale scaled. . . . . *lowisii*
Maxillary palpus brown with white scales; tarsi I, II each with tarsomere 5 brown scaled. . . . . *orbitae*

7(4). Tibiae I-III each with a subapical pale scaled band; scutellum* with brown scales on each lobe. . . . . *davidi*
Tibiae I-III each without a subapical pale scaled band; scutellum with white scales on each lobe. 8

8(7). Wing brown with numerous white scales (30% or more of scales white) intermixed on all dorsal veins, including distal 0.85 of radius 2+3 and tertiary fringe scales along posterior margin of female wing. 9
Wing without numerous white scales intermixed on all dorsal veins, distal 0.85 of radius 2+3 and scales along posterior margin of wing always brown. 10

9(8). Scutellum with only narrow curved white scales on midlobe; postpronotum completely covered with narrow curved pale scales. *taeniorhynchoides*
Scutellum with broad white scales and occasionally a very few narrow curved ones on midlobe; postpronotum with narrow curved reddish-brown scales dorsally and white ones below. . . . . *pipersalatus*

10(8). Proboscis completely covered with dark brownish-black scales. *stenoetrus*
Proboscis brown with numerous white scales ventrally. 11

11(10). Abdomen with terga III, IV each with an incomplete apical median longitudinal white stripe which may or may not connect with basal bands; lower subspiracular scale patch connects, or nearly so, with postspiracular scale patch. . . . . *vexans nipponii*
Abdomen with terga III, IV without apical median longitudinal white stripe; lower subspiracular scale patch does not connect with postspiracular scale patch. . . . . *vexans vexans*

12(3). Propleuron with narrow curved scales; scutum with 2-3 distinct longitudinal stripes of pale scales. 13
Propleuron with broad scales; scutum without stripes of pale scales. 14

13(12). Anterior margin of wing pale scaled; femora II, III each brown with an anterior median longitudinal white stripe. . . . . *pallidostriatus*
Anterior margin of wing brown scaled; femora II, III each without an anterior longitudinal white stripe. . . . . *mediolineatus*

14(12). Scutal integument pale with a pair of dark stripes on dorsocentral areas; tarsi yellow scaled. . . . . *nigrostriatus*
Scutal integument uniformly dark; tarsi brown scaled. 15

*But see Taxonomic Discussion page 34.

15(14). Scutellum with narrow curved white scales on each lobe; subspiracular area with 2 patches of broad white scales. . . . . *culicinus*
Scutellum with broad silvery-white scales on each lobe; subspiracular area with 1 patch of moderately broad white scales or with a patch of short fine hairs and without scales. 16

16(15). Abdomen with dorsobasal white bands on terga III, IV; subspiracular area with a patch of short fine hairs. . . . . *alboscutellatus*
Abdomen without dorsobasal pale bands on terga III, IV; subspiracular area with a patch of white scales. . . . . *pampangensis*

KEY TO THE PUPAE*

1. Patch of spicules between bases of metanotal hairs 10-C and abdominal hairs 1-I. 2
Areas between bases of metanotal hairs 10-C and abdominal hairs 1-I without spicules. 3

2(1). Hair 10-C with 7-11 branches; hair 6-I single; hair 1-II with 20-32 branches. . . . . *caecus*
Hair 10-C with 17-33 branches; hair 6-I double or triple; hair 1-II with 33-65 branches. . . . . *orbitae*

3(1). Ventral posterior margin of II with spicules mesally. . *vexans vexans vexans nipponii*
Ventral posterior margin of II without spicules mesally. 4

4(3). Hair 7-C with 8-11 branches; hair 6-VI with 6-8 branches. *pampangensis*
Hair 7-C with 2-6 branches; hair 6-VI single to 4 branched. 5

5(4). Hair 1-II with 3-7 branches. . . . . *alboscutellatus*
Hair 1-II with 9-49 branches. 6

6(5). Hair 10-C with 5-9 branches. 7
Hair 10-C with 10-33 branches. 8

7(6). Hair 4-II with 2-5 branches. . . . . *culicinus*
Hair 4-II with 7-16 branches. . . . . *pipersalatus*

8(7). Hair 1-I with 17-30 branches. . . . . *mediolineatus*
Hair 1-I with 30-46 branches. . . . . *pallidostriatus*

KEY TO THE FOURTH STAGE LARVAE*

1. Siphon with patches of spicules, these may be restricted to apex. . 2
Siphon without spicules. 3

*The immature stages of *davidi, lowisii, nigrostriatus, punctifemoris* and *wainwrighti* are not known.

2(1). Siphon with lateral patch of spicules near middle; head hair 6-C with 6-9 branches. . . . . *orbitae*
Siphon without lateral patch but usually with a dorsal patch of spicules; head hair 6-C with 4-5 branches. . . . . *caecus*

3(1). Mesothoracic hair 5-M double or triple; siphon long, index 7.50-9.00. *pampangensis*
Mesothoracic hair 5-M single; siphon short to moderately long, index 2.11-7.91. 4

4(3). Comb scales short, without a long median spine but with lateral denticles. 5
Comb scales with a long stout pointed median spine and short denticles along lateral margins of base. 6

5(4). Siphon index 5.00-5.56; abdominal hair 10-I double. . . *pipersalatus*
Siphon index 3.00-4.08; abdominal hair 10-I single. . *alboscutellatus*

6(4). Head hair 6-C single to double; head hair 8-C single. 7
Head hair 6-C triple to 6 branched; head hair 8-C double to 8 branched. 8

7(6). Head with frontaclypeus granulose. . . . . *vexans vexans*
Head with frontoclypeus without granules. . . . . *vexans nipponii*

8(6). Prothoracic hair 7-P double; metathoracic hair 7-T with 5-6 branches; siphon index 3.88-4.50. . . . . *culicinus*
Prothoracic hair 7-P triple; metathoracic hair 7-T with 7-14 branches; siphon index 5.93-7.91. . . . . *mediolineatus*
pallidostriatus

DESCRIPTIONS OF THE SPECIES OCCURRING IN SOUTHEAST ASIA

AEDES (AEDIMORPHUS) ALBOSCUTELLATUS (THEOBALD)
(Figs. 1, 16, 17, 18, 33, 34, 49, 59)

Lepidotomyia alboscutellata Theobald 1905, Ann. Mus. nat. Hung. 3: 80 (♀*); Brunetti 1907, Rec. Indian Mus. 1: 339.
Lepidotomyia Alboscutellata Theobald, Leicester 1908, Cul. Malaya, p. 132 (♂, ♀).
Culex argentinotus Banks 1909, Philipp. J. Sci. 4: 547 (♂, ♀).
Reedomyia alboscutella Theobald, Theobald 1907, Monogr. Cul. 4: 261 (♀*); Theobald 1910, Monogr. Cul. 5: 257.
Reedomyia alboscutellata Theob., Brunetti 1912, Rec. Indian Mus. 4: 487.
Ochlerotatus alboscutellatus Theob., Brunetti 1920, Rec. Indian Mus. 17: 139; Senior-White 1923, Cat. Indian Insects, Cul., p. 76.
Aëdes ōmurensis Yamada 1921, Annot. zool. jap. 10: 73 (♂* ♀).
Aedes (Ecculex) alboscutellatus Theobald, Edwards 1922b, Indian J. med. Res. 10: 467.
Aëdes (Aëdimorphus) alboscutellatus (Theo.), Edwards 1924, Bull. ent. Res. 14: 372 (♀); Barraud 1934, Fauna Brit. India, Diptera 5: 250 (♂*, ♀).

Aëdes (Aëdimorphus) alboscutellata Theobald, Dyar and Shannon 1925, Insecutor Inscit. menstr. 13: 76.

Aedes (Aedimorphus) alboscutellatus (Theobald), Barraud 1928, Indian J. med. Res. 15: 659 (♂*, ♀); Bohart 1945, Navmed. 580, p. 62; Hsiao and Bohart 1946, Navmed. 1095, p. 22; Penn 1949, nat. Hist. Misc. 40: 1 (P*, L*); La Casse and Yamaguti 1950, Mosquito Fauna Japan and Korea, p. 130 (♂*, ♀*); Knight and Hull 1953, Pacif. Insects 7: 457 (♂*, ♀, L*); Stone et al. 1959, Thomas Say Found. 6: 190; Belkin 1962, Mosquitoes S. Pacif., p. 425 (♂*, ♀, P*, L*); Assam and Bonne-Wepster 1964, Zool. Bijdr. 6: 96 (♂, ♀, L*); Mohrig 1967, Angew, Parasit. 8: 80 (♀*); Pao and Knight 1970, Mosquito Syst. Newsletter 2: 105 (L*); Kurihara 1963, Jap. J. sanit. Zool. 14: 196 (A*).

Aëdes (Aëdimorphus) alboscutellatus Theobald, Edwards 1932, Genera Insec., Fasc. 194: 167.

Aedes (Aedimorphus) alboscutellatus Theobald, Bonne-Wepster 1954, Doc. med. Geogr. Trop. 6: 236 (♂, ♀, L*).

FEMALE (Fig. 1). *Head.* Antenna dark brown, approximately 1.14 length of proboscis, pedicel pale with a few small brown scales and a patch of short fine brown hairs mesally, flagellomere 1 with basal 0.50 pale and with a few small brown scales; clypeus dark, bare; maxillary palpus brown scaled, approximately 0.17 length of proboscis; proboscis brown scaled with a ventral pale area from near base to apical 0.25, approximately 1.12 length of femur I; vertex with dosum covered with narrow decumbent scales arranged in an anteromedian diamond-shaped brown group and the remainder whitish; lateral surface covered with broad pale scales, an anterodorsal dark patch and a dusky area anterior to antepronotum; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument brown; scutum covered with narrow curved reddish-black scales, narrow curved white scales forming distinct spots on scutal fossal areas (lateral and posterior) and supra-alar area at base of wing, indistinct spots on anterior promontory area, anterior scutal fossal area and at scutal angle, a few similar scales scattered on area mesally to acrostichal setae and along lateral margins of prescutellar space; scutellum with a patch of long, broad overlapping silvery scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-3 lateral and 1-2 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument brown; antepronotum with narrow curved and a few broad white scales, several moderately long brown bristles; postpronotum with narrow dark brown scales dorsally and a few white ones posteroventrally, 4-5 dark posterior bristles; propleuron with a patch of broad silvery-white scales, several dark bristles; postspiracular area with 6-7 light brown bristles; subspiracular area with a patch of short fine light brown hairs; mesepisternum with an upper and a posterior patch of broad silvery-white scales, several upper and posterior brown bristles, lower ones shorter; prealar knob with several dark brown bristles; paratergite with a few dusky-white scales (these scales usually rubbed off); mesepimeron with a patch of broad silvery-white scales and several brown bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several brown bristles, I with anterior surface covered with broad pale brownish scales and a small dorsal patch of silvery-white ones, II with an anterior patch of broad silvery-white scales, III with a small anteroventral patch of silvery-white scales; trochanters I-III with a few broad white

scales; femora I-III brown, I with a few lateroapical white scales, II, III each with a dorsoapical white spot, III with an anteroventral longitudinal pale stripe, wide at base and tapering at apex, I-III each with posterior surface with a longitudinal pale stripe, wide at base and tapering to apex, stripe dorsal on I and ventral on II, III; tibiae I, II brown, each with a dorsoapical white scale patch and a posteroventral longitudinal pale stripe, III brown with an apical white band; tarsi I-III brown; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with a patch of white scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. *Halter*. Pedicel pale, capitellum brown scaled. *Abdomen*. Tergum I brown with a rectangular patch of white scales on laterotergite; terga brown, III-VII each with a few dorsobasal pale scales (pale scales occasionally forming narrow indistinct bands), a few dorsomedian pale scales on VI in some specimens, II-VII each with a large laterobasal white spot; sterna white each with apical 0.25 brown scaled, brown apical bands broader on posterior sterna; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 18). Tergum VIII index 1.02-1.04; sternum VIII index 0.88-0.92; tergum IX bilobed with 3-8 bristles on each lobe, index 1.18-1.23; insula tongue-like, covered with minute setae and with 4-5 small tuberculi on apical 0.20; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderate to heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 5-8 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.89-1.24, ventral PGL index 2.16-2.50; cercus long, 0.80-0.90 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 3.35-4.25, cercus/dorsal PGL index 3.90-5.12; 3 spherical, pigmented seminal capsules, 1 large and 2 tiny rudimentary ones.

MALE (Fig. 1). Similar to female in general habitus. *Head*. Maxillary palpus brown, longer than proboscis by length of apical segment; proboscis dark brown scaled with a small ventral pale spot near middle; vertex without anterodorsal dark patch on lateral surface. *Thorax*. Antepronotum with a few broad pale scales; postpronotum with fewer scales. *Legs* (Fig. 17). Posttarsi I-III each with 2 ungues, I, II with ungues unequal each bearing a tooth, III equal, simple. *Abdomen*. Tergum I with a lateral band of white scales on laterotergite; terga III-VIII each with a broad basal pale band; sternum VIII white scaled. *Genitalia* (Figs. 33, 34). Tergum IX strongly bilobed with 4-6 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with short fine bristles forming an elongate patch along tergomesal margin from apex to base and extending over basal 0.25, long stout bristles along outer lateral margin from base to apex and on apical 0.35 of ventral surface, scattered short to moderately long bristles mesally on basal 0.65 of ventral surface, scattered scales on lateral and ventral surfaces; gonostylus with pedicel narrow and short, distal 0.50 greatly expanded with a lateroapical horn-like flap bearing a number of moderately long fine hairs, mesal margin of expanded portion with a moderately long flattened, pigmented gonostylar claw near base and 3 small and 1 medium-sized accessory claws distally, 3-4 moderately long fine hairs along apical margin and 9-16 short fine hairs scattered over tergal surface of expanded area; basal mesal lobe short and rounded apically, distal 0.40 with 2-3 short and 1 moderately long bristles, a long narrow lightly pigmented filament

extending from apex to near base of gonostylus and attached to mesal membrane of gonocoxite, entire surface of basal portion covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 5-6 short, blunt, lateral teeth on distal 0.55 and covered with a dorsal flap, paramere long, approximately 0.83 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 3-5 bristles near center.

PUPA (Fig. 49). Chaetotaxy as figured and recorded in Table 1. *Cephalothorax*. Hair 5-C with 4-6 branches, 7-C with 3-4 branches; 8-C with 5-9 branches. *Respiratory trumpet*. Moderately pigmented; index 3.50-4.50, average 3.87. *Metanotum*. Hair 10-C with 3-5 branches; 12-C with 4-7 branches. *Abdomen*. Hair 5-I with 6-11 branches; 1-II with 3-7 branches; 4-II with 2-5 branches; 1-III with 6-10 branches; 6-VI with 2-4 branches; 1-VII with 4-6 branches; 6-VII with 4-10 branches; 9-VII with 2-5 branches; 11-VII double or triple. *Paddle*. Ovoid; with very minute serrations along basal 0.50 of outer margin; tiny spicules along apical 0.50 of outer and apical 0.20 of inner margins; midrib does not reach apex; hair 1-P short, double or triple; index 1.09-1.30, average 1.21.

LARVA (Fig. 59). Chaetotaxy as figured. *Head*. Hairs 1, 3-C single; 4-C with 6-10(8) branches; 5-C with 3-7(3) branches; 6-C with 2-5(3) branches; 7-C with 4-8(6) branches; 8-C with 2-4(4) branches; 9, 11-C with 3-6(4) branches; 10-C double or triple (3); 12-C with 3-5(5) branches; 13-C double or triple (2); 14-C single or double (1); 15-C with 3-7(4) branches; basal maxillary hair single; mental plate with 32-36(34) teeth. *Antenna*. Lightly pigmented; numerous spicules on basal 0.25 and a few scattered over remainder of shaft; hair 1-A with 5-7(5) branches, inserted at 0.40-0.47 from base; 2-A long; 3-A approximately 0.34 length of 2-A. *Thorax*. Hair 0-P with 6-11(10) branches; 1, 5, 6, 12-P single; 2-P with 2-4(3) branches; 3-P with 3-4(4) branches; 4-P with 3-7(4) branches; 7, 11-P with 2-4(2) branches; 8, 10-P single or double (1); 9-P double or triple (3); 14-P single to triple (2); 1-M with 3-7(4) branches; 2-M with 2-4 (2) branches; 3-M with 3-5(3) branches; 4-M with 4-9(5) branches; 5, 7, 10, 12-M single; 6-M with 3-5(4) branches; 8-M with 5-7(6) branches; 9-M with 6-7(6) branches; 11-M single or double (1); 13-M with 5-10(7) branches; 14-M with 4-10(8) branches; 3-T with 7-12 (11) branches; 4-T with 3-4(4) branches; 6-T with 2-5(4) branches; 7-T with 5-7(6) branches; 8-T with 5-12(7) branches; 9-T with 4-6(5) branches; 11-T single or double (2); 12-T single to triple (2); 13-T with 9-19(14) branches. *Abdomen*. Hairs 1, 2-VIII on common basal plate; 0, 14-VIII single; 1-VIII with 6-11(6) branches; 2-VIII with 2-4(3) branches; 3-VIII with 6-16(9) branches; 4-VIII single or double (2); 5-VIII with 5-9(7) branches; 6-III-VI short; comb with 17-25(19) scales arranged in 3 irregular rows, scales each short and blunt with stout denticles on margins and apex; 1-X double or triple (2); 2-X with 7-12(11) branches; 3-X single; ventral brush varies from 9 hairs on grid and 3 precratal ones to 12 hairs on grid and 2 precratal ones, usually with 9 hairs on grid and 3 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus present; 4 anal papillae, long, each with a broad base and tapering to a pointed apex. *Siphon*. Moderately pigmented with minute ridges over entire surface; acus present; index 3.00-4.08; pecten with 15-20(17) teeth, apical 1-3 teeth smooth and wider spaced than remainder which have a slender apical attenuated filament with 1-2 basal denticles; hair 1-S with 4-6 (5) branches, inserted at 0.59-0.67 from base.

TYPE DATA. *Lepidotomyia alboscutellata* Theobald, holotype female, Simbang, Huon Gulf, *New Guinea*, AUSTRALIA, July 1898, Biro, in Magyar Nemzeti Museum, Budapest, Hungary; *Culex argentinotus* Banks, syntypes male and female, Pinagsalaan Well, Taytay, Rizal, *Luzon*, PHILIPPINES, 13-16 May 1909, C. S. Banks, types nonexistent (Stone et al. 1959: 190); *Aedes ōmurensis* Yamada, 4 female and 2 male syntypes, 5 female and 1 male paratypes, Ōmura, Kyushu, JAPAN, syntype No. 35, in Medical Zoology Laboratory, Institute for Infectious Diseases, University of Tokyo, Tokyo, Japan.

DISTRIBUTION. Specimens examined--241 males, 291 females, 170 pupae, 93 larvae and 172 individual rearings (137 pupal, 35 larval) from the following locations:

AUSTRALIA. *N.E. New Guinea*, Milne Bay; *Papua*, Trobriand Islands, Kiriwina.

BISMARCK ARCHIPELAGO. Emirau Island.

INDIA. *Assam*, Golaghat.

INDONESIA. *Ceram*, Lisabata, Wahari; *Java*, Rawaloh, Tjibodas, Mt. Gede, Tjilatjap; *New Guinea*, Tanah Merah, Upper Digul River; Hollandia; *Sumatra*, Bengkoelem, Blang Kedjeren, Dermaja, Dramajoe, Benkoclen, Kotta Tjane, Mocra Tebo.

MALAYSIA. *Pahang*, Cameron Highlands, Kg. Sertik, Bentong; *Sarawak*, Kuching; *Sabah*, Beaufort, Tenom; *Selangor*, Kuala Lumpur, Ulu Gombak; Segambut.

PHILIPPINES. *Batangas*, Pto. Tomas; *Leyte*, Jinamoc Is.; *Luzon*, La Union, Anastacio, Bacnotan; *Mindoro*, Caminawit, Kabakan, San Jose; *Palawan*, Puerta Princesa; *Samar*, San Antonio, Calaccad, Tawi Tawi Is.

SOLOMON ISLANDS. Bunana; *New George Is.*, Munda; Empress, Augusta Bay, Bougainville, Guadalcanal.

SOUTH VIETNAM. *Binh Dinh*, Binh Dinh, An Khe; *Pleiku*, Pleiku.

THAILAND. *Khon Kaen*, Ban Maung Kao, Phu Wiang; *Krabi*, Ban Phru Toei; *Lampang*, Ban Na Kiang; *Maha Sarakham*, Muang; *Nakhon Ratchasima*, Pak Chong, Pak Thong Chai; *Nan*, Ban Pang Chom Phu, Ban Pang Mon, Ban Ta Loc, Pha Dang Khawi; *Narathiwat; Songkhla*, Haad Yai; *Ubon Ratchathani*, Chong Med; *Udon Thani*; Ban Pa Goi; Talum.

Other distribution.

ADMIRALTY ISLANDS (Belkin 1962: 427, Iyengar 1955: 42, 1960: 67).

AUSTRALIA. *New Guinea*, Friedrick-Wilhelmshafen, Simbang, Huon Gulf (Theobald 1905b: 81); Madang (Cooling 1924: 27); *Northern Territory*, Daly River, Doctor's Gully (Edwards 1924: 372); *Queensland* (Edwards 1922b: 467), Cairns (Doherty et al. 1963: 22), Innisfail (Standfast and Barrow 1969: 39).

BURMA (Edwards 1922b: 467); Bhamo (Barraud 1934: 251).

CEYLON. Matate (Senior-White 1923: 76).

INDIA. *Bombay Deccan*, Tavargatti; Upper Assam Valley (Barraud 1928: 659); Belgaum; *Bengal*, Sukna, Darjeeling; *Bihar*, Pusa; *Assam*, Sibsagar (Barraud 1934: 251); Poona City (Rao and Rajagopalan 1957: 10).

INDONESIA. *Borneo* (Brug 1926: 529); *Sumatra, Atchin; Benkoelen*, Air Prioeka; *Djambi; Lampong*, Lampong (Brug and Edwards 1931: 258); *Sumatra*, Moeara Tebo (Haga 1924: 830); *New Guinea*, Inanwatan, Hollandia, P. Pam, Sokori Plain (Assem and Bonne-Wepster 1964: 98); Morotai (Bonne-Wepster 1954: 237).

JAPAN. Ōmura, Kiushu (Yamada 1921: 76); Misawa AB, Yokota AB (Reisen et al. 1971: Tables 23 and 24).

MALAYSIA. *Sarawak*, Kampong Pangkalan Kuap (Macdonald et al. 1965: 338).

NEW BRITAIN (Taylor 1934: 20).

PHILIPPINES. *Zamboanga*, Pettit Barracks; *Mindanao* (Dyar and Shannon 1925: 77); *Rizal*, Taytay, Pinagsalaan Well (Banks 1909: 548); *Laguna*, Los Banos (Bohart 1945: 63); *Palawan*, Bacungan; *Samar*, Osmena; *Zamboanga*, Mercedes, Zamboanga City (Knight and Hull 1953: 459); Jinamoc Island; *Mindoro*, Calapan (Basio 1971: 11); Clark AB (Dowell, Libay and Baisas 1965: 14).

SOLOMON ISLANDS. Bougainville (Belkin 1962: 427).

THAILAND. Nakhon Phanom (Parrish 1968b: 2); U-Tapao (Reisen et al. 1971: Tables 4 and 8); *Kanchanaburi*, Sangkla-buri, Lai-nam, Ni-Thae (Harinasuta et al. 1970: 241).

SOUTH KOREA. Kimpo Air Base, Kusan Air Base, Kwang-Ju Air Base, Osan (Reisen et al. 1971: Tables 26 and 27).

SOUTH VIETNAM. Phan Rang (Parrish 1968a: 3); Nha Trang (Parrish 1969: 554); Chu Lai, Da Nang (Grothaus et al. 1971: 20).

YORK ISLAND (Taylor 1934: 20).

TAXONOMIC DISCUSSION. *Aedes alboscutellatus* is very similar to the following Oriental and Pacific Islands species in the adult habitus: *jamesi, lowisii, oakleyi, senyavinensis, culicinus* and *trukensis*. It can be easily separated from the first 2 species by the dark tarsi and from the latter 3 species by the broad silvery scales on the scutellum. *Aedes alboscutellatus* differs from *oakleyi*, by the following characters: femora II-III each with a dorsoapical silvery spot; abdominal terga with very narrow basal white bands; and head with an anterodorsal brown spot on lateral surface while *oakleyi* has: femora II, III each with a small lateroapical white spot; abdominal terga with broad basal white bands; and head entirely pale scaled.

In addition to the above features, *alboscutellatus* also has the subspiracular area with only short fine hairs and the postspiracular area without scales. The female possesses 1 large and 2 rudimentary seminal capsules and shares this feature with *culicinus, jamesi, lowisii, oakleyi, senyavinensis* and *trukensis*. The illustration of the female genitalia of *alboscutellatus* by Hara (1957: 91) shows 1 large and 2 slightly smaller seminal capsules and therefore must belong to some other species.

The male genitalia of *alboscutellatus* are similar to those of *culicinus, jamesi, lowisii, oakleyi* and *senyavinensis*. The following character combination can be used in separating *alboscutellatus* from these related species: gonostylus with 9-16 short fine hairs scattered over tergal surface of expanded area; gonostylar claw with apex pointed; 3-4 accessory claws; and basal mesal lobe with 3-4 bristles; *culicinus* possesses: gonostylus with 17-24 short fine hairs on tergal surface of expanded area; no accessory claws; and basal mesal lobe with 6-10 bristles; *jamesi* possesses: gonostylus with 20-24 short fine hairs on tergal surface of expanded area; 3 accessory claws; and basal mesal lobe with 3-4 bristles; *lowisii* possesses: gonostylus with 3-8 short fine hairs on tergal surface of expanded area; 4-5 accessory claws; and basal mesal lobe with 4-5 bristles; *oakleyi* possesses: gonostylus with 14-16 short fine hairs on tergal surface of expanded area; gonostylar claw with apex blunt; 2-3 accessory claws; and basal mesal lobe with 4 bristles; and *senyavinensis* possesses: gonostylus with 25-32 short fine hairs on tergal surface of expanded area; 2-3 accessory claws; and basal mesal lobe with 8-9 bristles.

The larva of *alboscutellatus* is similar to *pipersalatus* and can be recognized by a difference in the shape of the comb scales and the siphon index which is 3.00-4.08 and in *pipersalatus* it is 5.00-5.56.

BIOLOGY. The immatures are usually found in small, partially shaded, flood pools in secondary scrub vegetation and the adults are usually taken biting cattle and man in the shade of forests during the day. Immatures in Thailand have been collected from small and large flood pools, small and large stream pools, small rock pool; usually from turbid fresh water but also several times from clear fresh water; water with floating and submerged dead leaves and scarce floating aquatic vegetation; usually in partial shade but occasionally in unshaded areas; usually in secondary scrub vegetation in mountains, hills or plateau but also in secondary scrub in plains, bamboo groves in hills, deciduous forest in valleys, and rain forest in hills; and at an altitude of 250 to 1480 feet (most often at 820 to 1310 feet). Larvae were collected in association with the following species of mosquitoes: *Aedes caecus, culicinus, ferinus, imprimens, mediolineatus, uncus, vexans vexans, vigilax, vittatus; Anopheles balabacensis, bengalensis, culicifacies, kochi, maculatus; Culex annulus, bailyi, fuscocephalus, infantulus, malayi, nigropunctatus, pallidothorax, pseudovishnui, raptor, scanloni;* and *Uranotaenia macfarlanei.*

In the Philippines, immatures have been collected from water in ground pools, foxholes and sunlit roadside ponds; adults have been taken biting man and cattle and resting in foxholes. Adults have also been collected feeding on cattle, buffaloes and man in forests in Thailand, in the jungles of Ceram in the afternoon and in Malaysia during the evening. In Java, adults have been taken at an altitude of 4,000 feet and in New Guinea in light traps. Immatures have been collected from jungle pools in Malaysia, from a road rut completely covered with grass and from a ground pool in New Guinea and from clear water in a primary forest in Sumatra.

Immatures have been found in flooded swamp areas, woodland pools, rockholes and potholes in a streambed while adults were collected biting during the daytime in forested areas of the Solomon Islands (Belkin 1962: 426). In Malaysia, Macdonald (1957: 21) states this species bites man in inland forests and has been taken at treetop levels. Macdonald and Traub (1960: 100) also record the larvae in ground pools in this country. Steffan (1966: 212) in New Guinea found larvae in shallow pools at the edge of the jungle, open areas, wheel ruts and had taken the adults in carabao baited traps. In India, larvae were collected from jungle pools (Barraud 1928: 659, 1934: 251) and adults from indoor shelters (Rao and Rajagopalan 1957: 10). Penn (1948: 245) made a larval collection in the Philippines from a permanent ditch which contained clear, stagnant water with a pH of 6.5. Females have been taken at a light in Malaysia (Edwards 1928: 53). Grothans et al. (1971: 20) in Vietnam found larvae in ground pools, swamp margins and long standing stagnant ditches with ample shade while adults were collected from indoor resting stations and biting man during the daytime in densely shaded woods.

AEDES (AEDIMORPHUS) CAECUS (THEOBALD)
(Figs. 2, 16, 17, 19, 35, 50, 60, 61)

Culex caecus Theobald 1901, Monogr. Cul. 1: 413 (♀*); Giles 1902, Handb., 2nd. Ed., p. 415 (♀); Blanchard 1905, Moust., p. 305 (♀); Theobald 1905, Genera Insec., Fasc. 26: 26; Brunetti 1907, Rec. Indian Mus. 1: 343.

Pecomyia caeca Theobald, Theobald 1907, Monogr. Cul. 4: 268 (♂, ♀*); Theobald 1910, Monogr. Cul. 5: 260; Brunetti 1912, Rec. Indian Mus. 4: 459.

Geitonomyia Caecus (Theobald), Leicester 1908, Cul. Malaya, p. 134.
Ochlerotatus caecus Theob., Brunetti 1920, Rec. Indian Mus. 17: 137.
Aedes (Ecculex) caecus Theo., Edwards 1922b, Indian J. med. Res. 10: 467.
Aëdes (Aëdimorphus) caecus Theo., Brug 1924, Bull. ent. Res. 14: 436 (L*); Borel 1930, Coll. Soc. Path. exot. Monogr. 3: 271 (♂*, ♀*, L*); Edwards 1932, Genera Insec., Fasc. 194: 170; Barraud 1934, Fauna Brit. India, Diptera 5: 257 (♂*, ♀, L*).
Aedes (Aedimorphus) caecus (Theo.), Barraud 1928, Indian J. med. Res. 15: 663 (♂*, ♀); Stone et al. 1959, Thomas Say Found. 6: 191.
Aedes (Aedimorphus) caecus Theobald, Bonne-Wepster 1954, Doc. med. Geogr. Trop. 6: 237 (♂, ♀*, L*).

FEMALE (Fig. 2). *Head.* Antenna dark brown, approximately 1.10 length of proboscis, pedicel pale with a few small pale scales and a patch of short fine black hairs mesally, flagellomere 1 pale with a few small brown scales; clypeus dark brown, bare; maxillary palpus brown scaled, approximately 0.18 length of proboscis; proboscis brown scaled with pale scales on lateral and ventral surfaces from near base to distal 0.25, pale area somewhat broader basally, approximately 1.04 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in an anterior brown patch and white scales laterally and posteriorly; lateral surface covered with broad pale scales and an anterodorsal dark patch; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument dark brownish-black; scutum covered with narrow curved reddish-black scales, narrow curved white scale patches on median anterior promontory area, scutal fossal areas (extending from anterior area along margin and onto lateral area), along scutal ridge from scutal angle posteromesally onto dorsocentral setal line, supra-alar area from base of wing posteromesally to dorsocentral setal line, posterior medial scutal area and along margins of prescutellar space; scutellum with a patch of narrow curved white scales and a few broad white ones on each lobe, broad scales on lateral lobes longer than on median lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-3 lateral and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument dark brown; antepronotum with narrow curved white scales, several long golden to brown bristles; postpronotum covered with narrow curved scales, dark reddish-black ones anteriorly and dorsally, large lower patch of white ones, 6-7 posterior brown bristles; propleuron with a patch of broad white scales, several golden bristles; postspiracular area with a patch of broad white scales and a few narrow curved ones anteriorly, 5-8 golden bristles; subspiracular area with 2 patches of broad white scales, lower one larger; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with several golden bristles; paratergite with a row of moderately broad white scales on lateroventral margin; mesepimeron with a patch of broad white scales and several golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several dark brown bristles, I with anterior surface covered with broad white scales and a patch of brown ones at about middle, II with anterior surface covered with broad white scales, III with an anteroventral small patch of broad white scales; trochanters I-III each with a patch of broad white scales; femora I-III each with a dorsobasal white spot and a few apical white scales on lateral surfaces, I, II each with anterior surface

brown and a few pale scales on ventral surface, III with anterior and posterior surfaces brown with a white stripe from base to near apex, stripe broad basally and tapering to a point apically, I, II with posterior surface white with a brown stripe from base to apex, stripe ventral on I and dorsal on II; tibiae I-III brown, I with a posteroventral longitudinal white stripe and a dorsoapical white spot, II, III each with a posterior longitudinal white stripe, a narrow basal white band and a few dorsoapical white scales, stripe on III on apical 0.80; tarsi I, II brown with tarsomeres 1-3 each with a dorsobasal white spot; tarsus III with tarsomeres 1-3 each with a narrow basal white band, tarsomere 4 with a dorsobasal white spot; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with a patch of broad white scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. *Halter*. Pedicel pale, capitellum white scaled with a few brown scales mesally. *Abdomen*. Terga brown; tergum I with a few basomedian pale scales and a rectangular patch of white scales on laterotergite; terga II-VI each with a basal white band, bands wider on III-V in Thailand specimens; tergum VII with a few basomedian and apical white scales; terga II-VII each with a large laterobasal white patch covering most of lateral surface, a few brown scales forming an indistinct dark spot toward the center of each white patch, on some specimens white patch reduced or absent on VII and brown scales more numerous on lateral surfaces of III-VI; sterna white scaled with a narrow posterior brown band on III, IV and usually a few brown scales on posterior of V, VI; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 19). Tergum VIII index 0.98-1.01; sternum VIII index 0.79-0.85; tergum IX bilobed with 3-6 bristles on each lobe, index 0.95-1.05; insula tongue-like, covered with minute setae and with 4-6 small tuberculi on apical 0.25; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderately pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 4-8 bristles on each side of midline, covered with minute setae, dorsal PGL index 1.04-1.20, ventral PGL index 2.04-2.24; cercus moderately long, 1.00 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 2.52-2.79, cercus/dorsal PGL index 3.20-3.79; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 2). Similar to female in general habitus. *Head*. Maxillary palpus brown with segments 2-5 each with a white basal band, longer than proboscis by 0.50 length of apical segment; vertex with narrow scaled area reduced. *Legs* (Fig. 17). Posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple. *Abdomen*. Terga II-VII each with a narrow dorsobasal white band connected to a laterobasal white patch; tergum VIII completely white scaled; sterna III-VIII with a narrow posterior brown band. *Genitalia* (Fig. 35). Tergum IX strongly bilobed with 4-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface covered with scattered short fine bristles and a few moderately long ones on 0.30 of lateroapical margin, numerous long stout bristles along lateral margin from base to apex, ventral surface with long stout bristles on apical 0.25 and along distal 0.60 of sternomesal margin, a few moderately long bristles below and mixed with long ones, scattered scales on lateral and ventral surfaces; gonostylus with pedicel long and narrow, base somewhat broader, distal 0.38 expanded into a mesal lobe and a lateral, narrow,

apically rounded horn attached approximately 0.78 from base with a short fine hair at apex, mesal expanded lobe with a moderately long, somewhat flattened, apically pointed gonostylar claw attached mesally near base, 3-5 short stout bristles along apical margin, mesal one short and others each increasing in length, 3 short fine hairs along mesal margin of distal 0.50 of pedicel; basal mesal lobe short and rounded apically, distal 0.25 with 5-8 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.58 and covered with a dorsal flap, paramere long, approximately 0.90 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 7-15 bristles near center.

PUPA (Fig. 50). Chaetotaxy as figured and recorded in Table 2. Patches of spicules on middorsal ridge of cephalothorax extending to metanotum, on metanotum mesally between hairs 10-C and on abdomen between hairs 1-I. *Cephalothorax*. Hair 5-C with 2-5 branches; 7-C with 2-4 branches; 8-C with 5-7 branches. *Respiratory trumpet*. Lightly pigmented; index 3.67-4.21, average 3.85. *Metanotum*. Hair 10-C with 7-11 branches; 12-C with 5-8 branches. *Abdomen*. Hair 5-I with 6-10 branches; 1-II with 20-32 branches; 4-II with 2-5 branches; 1-III with 5-8 branches; 6-VI single or double; 1-VII with 2-5 branches; 6, 9-VII with 3-7 branches; 11-VII single. *Paddle*. Ovoid; with very minute serrations along basal 0.55 of outer margin; minute spicules on distal dorsolateral 0.25 of outer surface; midrib does not reach apex; hair 1-P short, single; index 1.14-1.47, average 1.25.

LARVA (Figs. 60, 61). Chaetotaxy as figured. *Head*. Hairs 1, 3, 14-C single; 4-C with 4-9(5) branches; 5-C with 5-7(5) branches; 6-C with 4-5(4) branches; 7-C with 7-11(9) branches; 8, 10-C with 2-4(3) branches; 9-C with 3-4(3) branches; 11-C with 4-10(6) branches; 12-C with 5-8(5) branches; 13-C with 5-8(6) branches; 15-C with 4-6(5) branches; basal maxillary hair single; mental plate with 22-26(24) teeth. *Antenna*. Lightly pigmented; spicules scattered over entire shaft, more numerous on basal 0.50; hair 1-A with 5-7(5) branches, inserted at 0.45-0.52 from base; 2-A long; 3-A approximately 0.50 length of 2-A. *Thorax*. Hair 0-P with 5-12(5) branches; 1, 5, 6, 10, 12-P single; 2, 8-P double; 3-P with 2-4(3) branches; 4, 11-P with 2-4(2) branches; 7-P double or triple (3); 9-P single to triple (2); 14-P single to double (1); 1-M with 3-6(3) branches; 2-M single to 5(1) branched; 3, 11-M single to double (1); 4-M with 3-7(3) branches; 5, 7, 10, 12-M single; 6-M with 4-7(5) branches; 8, 9-M with 5-9(7) branches; 13-M with 4-10(8) branches; 14-M with 6-12(8) branches; 1, 12-T single to triple (1); 2-T with 3-6(5) branches; 3-T with 6-16(9) branches; 4-T with 3-5(4) branches; 5, 10-T single; 6-T with 2-4(3) branches; 7-T with 7-10(9) branches; 8-T with 4-7(5) branches; 9-T with 4-8(7) branches; 11-T single or double (1); 13-T with 6-9(8) branches. *Abdomen*. Hairs 0, 4, 14-VIII single; 1-VIII with 5-8(6) branches; 2-VIII with 2-4(3) branches; 3-VIII with 8-15(12) branches; 5-VIII with 4-7(5) branches; 6-V-VI short; comb with 23-32(24) scales arranged in 3 irregular rows, scales short and bluntly rounded with short stout denticles along lateral and apical margins; 1, 3-X single; 2-X with 8-12(11) branches; ventral brush with 9-10 (usually 10) hairs on grid and 1-2 precratal ones; saddle lightly pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus absent; 4 anal papillae, long, each with a broad base and tapering to a pointed apex. *Siphon*. Lightly pigmented with ridges over entire surface; 2-4 rows of stout spicules circling apex; usually a dorsal and a ventral patch of spircules at about middle of siphon, these patches vary considerably from one to both absent

to both extending over 0.45 of the siphon; acus absent; index 3.13-3.47; pecten with 16-23(21) teeth, apical 2-3 teeth longer, smooth and wider spaced than remainder which have a slender apical attenuated filament with 1-3 basal denticles; hair 1-S with 4-6(5) branches, inserted at 0.77-0.83 from base.

TYPE DATA. *Culex caecus* Theobald, holotype female, Klang Mangrove Swamp, *Selangor,* MALAYSIA, 28 October 1899, A. L. Butler, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--525 males, 827 females, 565 pupae, 814 larvae and 788 individual rearings (384 pupal, 404 larval) from the following locations:

BANGLADESH (East Pakistan). *Chittagong Hill Tracts,* Rangamatti.

CAMBODIA. Phnom-Penh.

CHINA. *Wangtun,* Canton Delta, Sam Shui, Wang Mun; *Chekiang,* Shanghai; *Yunnan.*

INDIA. *Assam,* Chabua, Dibrugarb, Doom Dooma, Tezpur; Malabar Coast.

INDONESIA. *Ceram,* Ilatoenoera; *Java,* Batavia, Gomrong, Padaherang, Pelaboean Ratoe, Rawallah, Uodjowarna; *Sumatra* (?), Katta Tjane.

MALAYSIA. *Kedah,* Bt. Kayu Hitam, Changlum, Kg. Peng Besar, Sintok F. R.; *Kelantan,* Bertam; *Pahang,* Bt. Belong, Chegar, Kuantan, Kuala Lipis, Merapoh, Perah; *Perak,* Kuala Kangsar; *Perlis,* Bt. Bintang F. R., Chior F. R., Kg. Gunong, Kg. Prok Buah, Kubang Tiga, Mata Ayer, To'Kayaman; *Selangor,* Ampang F. R., Banting, Klang Mangroves, Puchong, Rantau Panjang, Segambut, Ulu Gombak, Ulu Klang; *Trengganu,* Kula Brang, Kuala Dura, Marang, Payang Kayu; Segambut, Serdang.

PHILIPPINES. *Palawan,* Panitian.

SINGAPORE.

SOUTH VIETNAM. *Binh Dinh,* An Khe; *Nha Trang,* Duc My; *Phuoc Long,* Bu Dop; *Tay Ninh,* Tay Ninh.

THAILAND. *Chiang Mai,* Chiang Mai, Huey Keo; *Kanchanaburi,* Ban Sai Yok, Farng, Huai Bong Ti, Huai Mae Nam Noi, Khao Na Chang, Maki; *Khon Kaen,* Ban Muang Kao, Phu Wiang; *Lampang* Ban Sop Pon, Ngao; *Mae Hong Son,* Ban Mae Tia, Doi Chang; *Nakhon Ratchasima,* Banna Nabon, Chawang, Dhong Suea Pan, Khoo Yai, Pak Chong, Pak Tong Chai; *Nakhon Si Thammarat,* Ban Rim Thanon, Ban Tan, Chaung Khao, Thung Song; *Nan,* Ban Pang Chom Phu; *Narathiwat,* Khan Lau, Waeng, Loh Choot; *Phangnga,* Khao Sung, Nam Tai, Pak Chaung, Pathum, Thap Wen; *Prachin Buri,* Ban Bu Phram, Ban Tub Lan; *Ranong,* Ban Bang Hin, Ban Chatri, Kraburi, Vat Pra Chum Pharam; *Songkhla,* Haad Yai; *Surat Thani,* Ban Cha Weng, Ban Tai, Ban Tahing Ngam, Ban Thurian, Laen Thong Lak, Ko Samui; *Tak; Trang; Udon Thani,* Ban Kau Noi, Ban Pa Goi, Tai Ton Kam Phoo, Muang.

Other distribution.

BANGLADESH (East Pakistan). Rangamatti, *Chittagong Hill Tracts* (Barraud 1934: 258); *Thakurgaon,* Akcha, Madargonj (Aslamkhan and Wolfe 1971: 31).

BURMA. Rangoon (Barraud 1934: 258).

INDIA. *Assam,* Dinapur; *Bengal,* Sukna; Colaghat (Barraud 1934: 258); Sukna, E. Himalayas (Theobald 1910a: 21, Theobald 1910b: 299).

INDONESIA. *New Guinea; Sumatra* (Brug 1926: 529, McDonald 1957: 21); *Sumatra,* Atchin, Kotta Tjane; Djambi, Moeara Tebo (Brug and Edwards 1931: 258).

MALAYSIA. *Selangor,* Kepong Panjang (McDonald 1957: 21).

NEPAL. *Gandaki,* Kaski, Pokhara (Joshi et al. 1965: 139).

SINGAPORE (Colless 1959: 260).

SOUTH VIETNAM (Borel 1930: 271); Cam Ranh Bay (Reisen et al. 1971: Table 12).

THAILAND. Chieng Moeang (Causey 1937: 413); *Kanchanaburi,* Sangkla-buri, Lai-nam, Ni-thae (Harinasuta et al. 1970: 241).

TAXONOMIC DISCUSSION. *Aedes caecus* shares a number of characters with *vexans vexans* which became evident during this study when a number of adult female *caecus* were found in several museum collections labeled as *vexans*. It can be separated from *vexans vexans* by the following features: femur II with anterior brown scaled; scutum with 3-4 bristles on scutal fossal area; scutellum with both narrow curved and broad white scales on each lobe; postspiracular area with 5-6 bristles; prealar knob without scales; and female palpus brown while *vexans vexans* has: femur II with white scales intermixed with brown ones on anterior surface; scutum with 7-10 bristles on scutal fossal area; scutellum with narrow curved golden-white scales on each lobe; postspiracular area with 8-9 bristles; prealar knob with a few broad white scales; and female palpus with apex white scaled. *Aedes caecus* also superficially resembles *culicinus* from which it is easily distinguished by the banded tarsi.

The pupa is characterized by the following features: a large patch of spicules mesally between metanotal hairs 10-C and abdominal hairs 1-I (*orbitae* has a similar arrangement of spicules but is easy to separate on branching of hair 10-C); hairs 10-V, VI long and single; and hair 7-VI long and single.

The larval stage resembles *orbitae* and is discussed under that species.

Edwards (1913: 228) synonymized *Aedes suknaensis* Theobald with *Aedes imprimens* Walker but later (1934: 170) he questionably included it with *caecus*. Barraud (1928: 663) listed *suknaensis* as a synonym of *imprimens* but stated that he thought *suknaensis* and *caecus* were possibly conspecific. In this same article (Plate 61, Fig. 1) he also illustrated the male genitalia of *caecus* but mistakingly called it *imprimens*. Later, Barraud (1934: 257) followed Edwards and listed *suknaensis* as a synonym of *caecus*. I have examined a cotype of *suknaensis* from Sukna, India, in the British Museum (Natural History) and find it not to be *caecus* but very similar to *imprimens*. It differs, however, from *imprimens* in having denser patches of scales on the pleural thoracic areas and scutellum and possessing a number of short fine golden hairs mixed with the single patch of broad white scales on the subspiracular area. *Aedes suknaensis* belongs in the subgenus *Edwardsaedes* Belkin and may be a distinct species from *imprimens*, but since no males have been found and the habitus of the adults are very similar I am retaining it with *imprimens* for the present.

Aedes caecus can be separated from *imprimens* by having 2 patches of scales on the subspiracular area while the latter species has a single patch.

BIOLOGY. Immatures are usually collected from partially shaded, small flood pools and animal footprints containing turbid fresh water located in bamboo groves and forests. Adults readily feed on cattle and man. Immatures in Thailand were collected most often from small and large flood pools, wheel tracks and elephant footprints but also from a small flood pool in a streambed, small ditch, large ground pit, posthole and a small rice field; usually from clear or turbid fresh water but several times from colored fresh water; water usually with floating and submerged dead leaves or scarce aquatic vegetation; in partial shade or unshaded areas and once from a heavy shaded area; usually in primary bamboo groves and secondary and primary rain forests in mountains and plains but also in coconut, palm, bamboo and rubber groves in the plains, secondary scrub in valley and plains, and secondary rain forest

in a valley; and at an altitude of 7 to 1,970 feet (most often from 100 to 750 feet). Larvae were collected in association with the following species of mosquitoes: *Aedes alboscutellatus, andamensis, culicinus, ferinus, gubernatoris, imprimens, indicus, mediolineatus, orbitae, vexans vexans, vittatus; Anopheles balabacensis, indiensis, kochi, maculatus, philippinensis, subpictus, vagus, Culex bitaeniorhynchus, fuscocephalus, mimulus, nigropunctatus,pallidothorax, pseudovishnui, raptor, scanloni, sinensis;* and *Uranotaenia bicolor.* Adults were taken in light traps and biting cattle and man in bamboo groves and underbrush.

Larvae in South Vietnam were taken from water in a tire, marshy depression, rock pool, foxhole, ground pools, artifical container, pool in a concrete piling and a jungle pool. In Java, larvae were collected in wheel ruts and adults taken indoors. Adults were collected biting cattle, and larvae from hoofprints and a small pool in Malaysia. Larvae in India were found in muddy puddles and a swamp.

Larvae were collected from a buffalo wallow on a high plateau in Thailand (Causey 1937: 413); ground pools in China (Chow 1949: 129); and natural pools in open jungle in India (Barraud 1934: 258) and New Guinea (Steffan 1966: 212). In Malaysia, adults readily fed on man and domestic animals and immatures were collected from pools and earthenware pots (Macdonald 1957: 21). Aslamkhan and Wolfe (1971: 31) in Bangladesh (East Pakistan) collected adults resting in a house, biting cattle and biting humans.

AEDES (AEDIMORPHUS) CULICINUS EDWARDS
(Figs. 3, 16, 17, 20, 36, 51, 62)

Aedes (Ecculex) culicinus Edwards 1922a, Indian J. med. Res. 10: 271 (♂*, ♀); Edwards 1922b, Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) culicinus (Edw.), Barraud 1928, Indian J. med. Res. 15: 667 (♂*, ♀).

Aedes (Aedimorphus) culicinus Edwards, Edwards 1932, Genera Insec., Fasc. 194: 169; Barraud 1934, Fauna Brit. India, Diptera 5: 252 (♂*, ♀).

Aedes (Aedimorphus) culicinus Edwards, Stone et al. 1959, Thomas Say Found. 6: 191.

FEMALE (Fig. 3). *Head.* Antenna dark brown, approximately equal in length to proboscis, pedicel dark with a few small dusky scales and a patch of short fine brown hairs mesally, flagellomere 1 with a few dusky scales; clypeus dark, bare; maxillary palpus brown scaled, approximately 0.17 length of proboscis; proboscis brown scaled with a pale ventral stripe extending from near base to distal 0.25, approximately 1.06 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in an anteromedian diamond-shaped brown group and the remainder white; lateral surface covered with broad white scales, an anterodorsal dark patch and a dusky area anterior to the antepronotum; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to the ocular line. *Thorax.* Scutal integument dark brown; scutum covered with narrow curved reddish-brown scales; narrow curved white scales forming patches on anterior promontory area, scutal fossal areas (one on anterior extending along margin onto lateral area and a patch on posterior area), scutal angles, supra-alar areas, posterior medial scutal area and along lateral margins of prescutellar space; scutellum with a patch of narrow curved white scales on each lobe; median anterior promontory, acro-

stichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 3-4 lateral, 1-2 median and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed; pleural integument brown; antepronotum with narrow curved white scales and some moderately broad ones, several long brown bristles; postpronotum with narrow curved brown scales dorsally and white ones posteriorly, a lower posterior patch of broad white scales, 5-7 posterior brownish bristles; propleuron with a patch of broad white scales, several pale bristles; postspiracular area with a patch of broad white scales, 5-7 golden bristles; subspiracular area with 2 patches of broad white scales, lower one larger; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior pale bristles, lower ones shorter; prealar knob with several pale brown bristles; paratergite with a row of broad white scales; mesepimeron with a patch of broad white scales and several pale bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several pale bristles, I with anterolateral white scales and a lateral brown patch, II with anterior surface white scaled; trochanters I-III each with a patch of broad white scales; femora I-III each with a few pale lateral scales at apex, II, III each with an anteroventral white stripe, wider on III, I-III each with a posterior broad white longitudinal stripe from base to approximately 0.75, stripe dorsal on I and ventral on II, III; tibiae I-III with anterior surface brown, a few dorsal and lateral pale scales at apices, posterior surface brown with a longitudinal pale stripe, I with stripe posteroventral, II, III with stripe posteromedian; tarsi I-III brown; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with white scales at base and on its posterior at humeral cross vein; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. *Halter*. Pedicel pale, capitellum white scaled. *Abdomen*. Terga brown; tergum I with a few dorsomedian white scales and a rectangular patch of white scales on laterotergite; terga II-VI each with a narrow dorsobasal white band; tergum VII with a triangular dorsobasal pale patch; terga II-VI each with a large laterobasal white spot, a few brown scales in center of spots, VII with a few lateromedian white scales; sterna pale scaled with lateromedian pale brown spots; terga and sterna with numerous pale golden bristles, mostly along posterior margins. *Genitalia* (Fig. 20). Tergum VIII index 1.04-1.09; sternum VIII index 0.97-0.99; tergum IX bilobed with 4-10 bristles on each lobe, index 0.91-1.12; insula tongue-like, covered with minute setae and with 3-5 small tuberculi on apical 0.25; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderate to heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 3-7 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.83-0.95, ventral PGL index 2.18-2.38; cercus moderately long, 0.60-0.75 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 2.97-3.17, cercus/dorsal PGL index 4.75-5.22; 3 spherical, pigmented seminal capsules, 1 large and 2 tiny rudimentary ones.

MALE (Fig. 3). Similar to female in general habitus. *Head*. Maxillary palpus with dorsal pale scale patches on middle of segments 2 and 3, longer than proboscis by length of apical segment; vertex without anterodorsal dark scale patch on lateral surface. *Legs* (Fig. 17). Posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple.

Wing. Dorsal veins completely brown scaled. *Abdomen*. Tergum I with a lateral band of white scales on laterotergite; terga II-VIII each with a narrow dorsobasal white band, usually 2-4 white scales on lateromedian surfaces of II-VII. *Genitalia* (Fig. 36). Tergum IX bilobed with 4-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with a large dense patch of short bristles along tergomesal margin from near base to distal 0.30, numerous long stout bristles on lateral margin from base to apex, ventral surface with similar bristles on distal 0.25 with moderately long and short ones proximally, scattered scales on lateral and ventral surfaces; gonostylus with pedicel short and broad, distal 0.50 greatly expanded with a laterotergal horn-like flap covered with numerous long fine hairs and terminating in an apical point, mesal margin of expanded portion with a short flat curved pigmented gonostylar claw mesally near middle, a patch of 6-14 fine hairs basal to claw and a tergal patch of 5-10 similar ones, 8-11 fine hairs along apical margin; basal mesal lobe short and rounded apically, distal 0.50 with 6-10 short bristles, a long narrow lightly pigmented filament extending from apex to near base of gonostylus and attached to mesal membrane of gonocoxite, entire surface of basal portion covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short, blunt, lateral teeth on distal 0.54 and covered with a dorsal flap, paramere long, approximately 0.78 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 3-5 bristles near center.

PUPA (Fig. 51). Chaetotaxy as figured and recorded in Table 3. *Cephalothorax*. Hair 5-C with 4-6 branches; 7-C with 3-5 branches; 8-C with 5-9 branches. *Respiratory trumpet*. Moderately pigmented; index 3.61-4.90, average 4.37. *Metanotum*. Hair 10-C with 6-9 branches; 12-C with 4-7 branches. *Abdomen*. Hair 5-I with 7-12 branches; 1-II with 14-20 branches; 4-II with 2-5 branches; 14-II single; 1-III with 7-13 branches; 6-VI double or triple; 1-VII with 5-8 branches; 6-VII with 6-9 branches; 9-VII with 4-5 branches; 11-VII double. *Paddle*. Ovoid; with very minute serrations along basal 0.55 of outer margin; tiny spicules along apical 0.45 of outer and apical 0.30 of inner margins; midrib does not reach apex; hair 1-P short, single or double; index 1.13-1.34, average 1.22.

LARVA (Fig. 62). Chaetotaxy as figured. *Head*. Hairs 1, 3, 14-C single; 4-C with 5-7(7) branches; 5-C with 3-4(3) branches; 6-C triple; 7-C with 4-6(6) branches; 8-C with 2-6(2) branches; 9-C with 2-5(5) branches; 10-C single or double (2); 11-C with 2-5(3) branches; 12-C with 3-4(4) branches, 13-C with 4 branches; 15-C double; basal maxillary hair single; mental plate with 23-25 teeth. *Antenna*. Moderately pigmented; scattered stout spicules over entire shaft, spicules somewhat longer past middle; hair 1-A with 5-8(7) branches, inserted at 0.37-0.42 from base; 2-A long; 3-A approximately 0.96 length of 2-A. *Thorax*. Hair 0-P with 7-10(8) branches; 1, 5, 6, 8, 10, 12, 14-P single; 2, 7, 11-P double; 3-P with 3-4(3) branches; 4-P double or triple (2); 9-P single or double (2); 1-M with 3-8(4) branches; 2-M with 2-4(3) branches; 3-M single or double (1); 4-M double or triple (3); 5, 7, 10-12-M single; 6-M with 4-6(4) branches; 8-M with 3-4(4) branches; 9-M with 3-6(5) branches; 13-M with 4-5(5) branches; 14-M with 5-8(5) branches; 1-T single to triple (3); 2-T with 4-13(6) branches; 3-T with 4-8(5) branches; 4, 9-T with 2-4(3) branches; 5, 10-12-T single; 6, 11-T single or double (2); 7-T with 5-6 (5) branches; 8-T with 4-6(4) branches; 13-T with 4-7(5) branches. *Abdomen*. Hairs 0, 14-VIII single; 1-VIII with 3-4(4) branches; 2-VIII double; 3-VIII with

7-10(8) branches; 4-VIII double or triple (2); 5-VIII with 5-7(5) branches; 6-IV-VI short; comb with 14-20(17) scales arranged in 2 irregular rows, scales each with a long stout pointed median spine and short denticles along lateral margins of base; 1-X double or triple (2); 2-X with 8-10(8) branches; 3-X single; ventral brush with 8-9 hairs on grid and 4 precratal ones; saddle lightly pigmented, incompletely rings segment, with a few spicules along posterior margin, acus absent; 4 anal papillae, long, tapering to a blunt apex. *Siphon.* Lightly pigmented; acus present; index 3.88-4.50; pecten with 11-14 (11) teeth, apical 2-4 teeth smooth and wider spaced than remainder which have a slender apical attenuated filament with 1-2 basal denticles; hair 1-S with 3-5(4) branches, inserted at 0.70-0.72 from base.

TYPE DATA. There has been some confusion about the location of the types of *Aedes (Ecculex) culicinus* Edwards. In the original description of the species, Edwards (1922a: 272) states the holotype male and allotype female were collected at Delhi, INDIA, April 1911, Major S. R. Christophers, and deposted in the Central Malaria Bureau, Kasauli, and 1 paratype female from Amritsar, INDIA, April 1911, Major S. R. Christophers, was deposited in the British Museum. Barraud (1928: 667) lists the holotype male in the Central Malaria Bureau and the allotype female and paratype female in the British Museum but in 1934 (page 252) he states all the types are in the British Museum. Stone et al. (1959: 191) lists the holotype male and allotype female in the Malaria Institute of India, Delhi, India. I have examined the collection in the British Museum (Natural History) and only the paratype female from Amritsar is there. The primary types are in the collection at the National Institute of Communicable Diseases, Delhi, India, which received the collections from the Central Malaria Bureau.

DISTRIBUTION. Specimens examined--17 males, 106 females, 105 pupae, 8 larvae, 105 individual rearings (105 pupal), from the following locations:

CAMBODIA. Kirirom.

INDIA. *Punjab,* Amritsar.

SOUTH VIETNAM. *Binh Dinh,* An Khe; *Kontum,* Kontum.

THAILAND. *Kanchanaburi,* Ban Sai Yok; *Khon Kaen,* Ban Muang Kao, Phu Wiang; *Ubon Thani,* Chongmek.

WEST PAKISTAN. *West Punjab,* Lahore.

Other distribution.

INDIA. Delhi, Kasauli (Edwards 1922a: 272); Karnal (Barraud 1934: 252).

WEST PAKISTAN. Lahore, Changa Manga National Forest (Aslamkhan and Salman 1969: 193).

TAXONOMIC DISCUSSION. The adult habitus and female and male genitalia of *culicinus* are similar to *alboscutellatus* and are discussed under that species. The most distinctive features of the adults are: scutellum with narrow white curved scales on each lobe; postpronotum with a few posterior broad white scales in addition to narrow curved ones; tarsi dark scaled; and female with 1 large and 2 rudimentary seminal capsules.

The most distinctive characters of the larvae are: comb of 14-20 scales each of which has a long stout pointed median spine and stout denticles along lateral margins of the base; pecten of 11-14 teeth; siphon index of 3.88-4.50; head hair 6-C triple; and metathoracic hair 9-T double or triple.

BIOLOGY. The immatures are usually found in partially shaded ground pools containing fresh water located in secondary scrub vegetation. The adults prefer feeding on cattle to man. Immatures in Thailand have been collected

from small to large turbid fresh water flood pools, with floating and submerged dead leaves, in partial shade, located in secondary scrub vegetation in the mountains or in teak plantations in the plains, and at an altitude of 650 to 1, 310 feet. In Malaysia immatures were taken in ground pools.

In Thailand immatures were collected in association with the following species of mosquitoes: *Aedes alboscutellatus, caecus, ferinus, imprimens, mediolineatus, pallidostriatus, vittatus*; *Anopheles kochi, maculatus;* and *Culex annulus, fuscocephalus, raptor.*

Aslamkhan and Salman (1969: 185, 186, 189, 193) in West Pakistan list *culicinus* as making up 7. 58 percent of the daytime and 12. 4 percent of the nighttime human biting mosquito collections. This species, however, preferred to feed on cattle to man at a ratio of 3:1 during nighttime tests. Adults made up 31. 6 percent of light trap mosquito collections. The immatures were found in ground pools with grassy margins and decomposing algae on the bottom. *Aedes culicinus* occurs in West Pakistan throughout the year but the numbers increase from April until a peak population is reached in July when relative humidity is very high and breeding places are abundant.

AEDES (AEDIMORPHUS) DAVIDI BASIO

Aedes (Aedimorphus) sp., Basio, White and Reisen 1970, Philipp. Ent. 1: 443.
Aedes (Aedimorphus) davidi Basio 1971, Nat. Mus. Philipp., Monogr. No. 4, p. 11 *(nomen nudum)*; Basio 1971, Philipp. Ent. 2: 51 (♂*) (validated name with description).

MALE. *Head.* Antenna with pedicel bare; proboscis dark with a distinct pale scaled area ventrally at middle; vertex covered with a mixture of pale and brownish scales; lateral surface with broad brownish colored scales. *Thorax.* Scutum covered with a mixture of pale and brown scales; scutellum with brown scales on lateral and median lobes; antepronotum with pale scales; postpronotum with brownish-yellow scales; postspiracular area with narrow pale scales; subspiracular area with narrow pale scales; mesepisternum with narrow pale scales; mesepimeron with narrow pale scales. *Legs.* Femora I-III each speckled with white scales with a few brownish colored scales laterally, apex without a white scaled spot; tibiae I-III each with a mixture of pale and brownish colored scales on anterior surface, ventral surface pale scaled and a subapical pale scaled band; tarsi I-III with pale bands; posttarsi I-III each with 2 ungues, I and II with ungues equally developed, III equal and simple. *Wing.* Length 3. 0 mm. *Abdomen.* Terga I-IV each with distinct pale scales laterally, V-VII each with pale scales basally, VIII pale scaled; sterna I-VIII with ground cover of brown scales. *Genitalia.* Tergum IX strongly bilobed with 3-4 short bristles on each lobe; gonocoxite long and moderately broad, dorsal surface with long stout bristles along lateral margin from base to apex, short thin bristles along tergomesal margin from base to apex, remainder of dorsal surface with short thin bristles, lateral surface with long stout bristles from base to apex; gonostylus approximately 0. 60 length of gonocoxite, with basal portion narrow and apical 0. 40 expanded and with several short fine hairs, gonostylar claw long, narrow, pigmented, with apex blunt and attached subapically; basal mesal lobe absent; proctiger moderately long, apex of paraproct bluntly pointed, cercal setae absent; phallosome with aedeagus of type II with 2 lateral plates connected basally, each plate apparently with 5 longidudinal lateral teeth with tergally curved apices.

FEMALE, PUPA, LARVA and EGG. Not described, however, Basio (1971: 52) states the holotype male has damaged pupal and larval skins.

TYPE DATA. *Aedes (Aedimorphus) davidi* Basio, holotype male with damaged larval and pupal skins and genitalia on slides, PHILIPPINES, Laguna, Los Banos, U. P. College of Agriculture Campus, 22 January 1970, collector D. W. White, from a rice field at 33 feet elevation, deposited in Philippine Museum, Manila and 1 paratype male with genitalia on a slide, same data as holotype, deposited in R. B. Basio collection (Basio 1971: 51, 52).

DISTRIBUTION. Known only from the type locality.

TAXONOMIC DISCUSSION. No specimens of *davidi* were available for examination, therefore the above description is taken from the original one by Basio (1971: 51-53). In his introductory remarks to the description of *davidi*, Basio states "The male of this species resembles that of *Aedes (Aedimorphus) vexans nocturnus* (Theobald)" (now considered as *vexans vexans*) "by the scalings of the dorsum, mesoscutum, scutellum, anterior and posterior pronotum, femora, tibiae, tarsi and abdominal tergites, and by having the torus bare." In his description of the scaling of the male that followed, however, he stated ". . . entire scutellum brown. . . abdominal tergites I to IV with distinct pale scales laterally, V to VII with pale scales basally and VIII entirely pale-scaled . . ." Basio's introductory remarks and species description do not coincide with each other. For example, *vexans vexans* from the Philippines and elsewhere possesses narrow curved white scales on the lateral and median lobes of the scutellum, not brown scales and the pedicel (torus) is not bare but has a few small, broad, white scales mesally. The abdominal terga of *vexans vexans* also have the following patterns: terga brown scaled without lateral white spots but with white scales covering laterotergite of I, II with a white basal band with posterior margin straight, III-VII each with a basal white band with lateral margins expanded posteriorly, VIII white scaled or white with a few brown scales mesally while Basio (1971: 51, 52) states that the abdominal tergites of *davidi* resemble those of *vexans vexans* but in his description of the male of *davidi* he reports the following: tergites I-IV with distinct pale scales laterally, V-VII with pale scales basally and VIII entirely pale scaled. The abdominal scale patterns reported for *davidi* are in fact quite different from those of *vexans vexans*.

From the description and male genitalia illustration *davidi* appears to have some similarity to *vexans vexans*; however, the following characters, as well as the above-mentioned ones, differ from the latter species: subspiracular area, mesepisternum and mesepimeron with narrow scales; femora I-III each without an apical white spot; tibiae I-III each with a pale subapical band and ungues of posttarsi I and II equally developed. The male genitalia of *davidi*, as illustrated and described by Basio (1971: 52, 53), also differ from those of *vexans vexans* by the following: gonostylus with basal portion narrow and apical 0.40 expanded and rounded, tergum IX bilobed with 3-4 bristles (illustration shows 5 bristles on each lobe), aedeagus with apparently 5 teeth on each lateral plate and the apparent absence of the basal mesal lobe. In my opinion the genitalia of the 2 type specimens must have been damaged and the basal mesal lobes lost since it would be most unusual to have this structure absent in *Aedimorphus*.

BIOLOGY. The 2 males were reared from larvae collected from a rice field at an elevation of 33 feet and in association with *Aedes vexans vexans* (Basio 1971: 52).

AEDES (AEDIMORPHUS) LOWISII (THEOBALD)
(Figs. 4, 16, 17, 21, 37)

Reedomyia lowisii Theobald 1910, Monogr. Cul. 5: 257 (♂*, ♀*); Brunetti 1912, Rec. Indian Mus. 4: 487.
Ochlerotatus lowisii Theob., Brunetti 1920, Rec. Indian Mus. 17: 140.
Aedes (Ecculex) lowisi Theobald, Edwards 1922b, Indian J. med. Res. 10: 466.
Ochlerotatus lowisi Theobald, Senior-White 1923, Cat. Indian Insects, Cul., p. 79.
Aedes (Aedimorphus) lowisii(Theo.), Barraud 1928, Indian J. med. Res. 15: 658 (♀); Stone et al. 1959, Thomas Say Found. 6: 194.
Aëdes (Aëdimorphus) lowisi Theobald, Edwards 1932, Genera Insec., Fasc. 194: 168; Barraud 1934, Fauna Brit. India, Diptera 5: 250 (♂, ♀).
Aedes (Aedimorphus) mindoroensis Knight and Hull 1951, Pacif. Sci. 5: 199 (♂*, ♀); Knight and Hull 1953, Pacif. Sci. 7: 459 (♂, ♀); Stone et al. 1959, Thomas Say Found. 6: 194. NEW SYNONYM.

FEMALE (Fig. 4). *Head.* Antenna dark brown, approximately 0.91 length of proboscis, pedicel brown with several small pale scales and a patch of short fine brown hairs mesally, flagellomere 1 with a few small dark scales; clypeus dark, bare; maxillary palpus dark brown scaled, approximately 0.17 length of proboscis; proboscis dark brown scaled with a pale ventral stripe extending from near base to distal 0.25, pale area narrow basally becoming broad distally, approximately 1.18 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in an anteromedian diamond-shaped dark group and the remainder golden; lateral surface covered with broad pale scales, an anterodorsal dark patch and a dusky area anterior to antepronotum; numerous long dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument reddish-brown; scutum covered with narrow curved reddish-black scales, scattered narrow curved white scales forming indistinct spots on anterior promontory area, supra-alar areas, and posterior medial scutal area, similar scales forming a distinct pair of small circular patches on both anterior and posterior scutal fossal areas; scutellum with a patch of broad silvery scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 1 lateral and 1-2 median), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles black and well developed, others absent; pleural integument dark brown; antepronotum with a few narrow curved pale scales, several long dark bristles; postpronotum with scattered narrow curved dark brown scales on dorsal 0.50, 5-6 posterior long brownish-black bristles; propleuron with a patch of broad pale scales, several short golden bristles; postspiracular area with 5-7 brown or black bristles; subspiracular area with a few narrow brownish hair-like scales; mesepisternum with an upper and a posterior patch of broad silvery scales, several upper and posterior dark bristles, lower ones shorter; prealar knob with several golden-brown bristles; paratergite bare; mesepimeron with a patch of broad silvery scales and several brown bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several golden bristles, I with anterior surface covered with broad brownish scales and a small patch of broad white ones dorsally and one ventrally, II with a patch of broad white scales anteriorly, III with a few broad white scales anteroventrally; trochanters I-III each with a patch of broad white scales; femur I with an anterior and a posterior apical white spot, II, III with a dorsoapical white spot, I, II with

anterior surface brown, I with a posterior narrow dorsal pale line from base to apex, pale area broad basally and tapering apically, I with a posteroventral white stripe, II with a posterodorsal white stripe, III brown with anterior and posterior ventrobasal white areas, areas broad basally and tapering to a point at about 0.25 from apex; tibiae I-III brown, each with a dorsoapical white spot; tarsi I-III brown, I with tarsomere 1 having a few dorsoapical yellowish scales, tarsomere 2-4 each with a few dorsobasal and dorsoapical yellowish scales, tarsomere 5 covered with yellowish scales, II with tarsomere 1 having a few dorsoapical yellowish scales, tarsomere 2 with a few dorsobasal and dorsoapical yellowish scales, tarsomere 3-4 each with a narrow basal yellowish band and a few dorsoapical yellowish scales, tarsomere 5 completely covered with yellowish scales, III with tarsomere 1 having a few dorsoapical pale scales, tarsomeres 2-4 each with a narrow pale basal band and a few dorsoapical pale scales, tarsomere 5 completely pale scaled. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with a patch of broad silvery scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. *Halter*. Pedicel pale, capitellum brown scaled. *Abdomen*. Terga brown with a few dorsobasal pale scales forming narrow bands on III-VI, a small triangular dorsobasal pale spot on VII; tergum I with a rectangular patch of white scales on laterotergite; terga II-VII with large laterobasal white spots; sterna with pale basal scales and brown apical ones, apical brown band becomes broader on posterior sterna; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 21). Tergum VIII index 1.10-1.30; sternum VIII index 0.79-0.95; tergum IX bilobed with 4-5 bristles on each lobe, index 1.20-1.47; insula tongue-like, covered with minute setae and with 3-5 small tuberculi on apical 0.20; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite medium to large sized, moderate to heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 6-8 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.95-1.22, ventral PGL index 2.30-2.83; cercus long, 0.75-1.00 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 3.21-3.88, cercus/dorsal PGL index 3.88-4.53; 3 spherical, pigmented seminal capsules, 1 large and 2 tiny rudimentary ones.

MALE (Fig. 4). Similar to female in general habitus. *Head*. Maxillary palpus brown, longer than proboscis by length of apical segment. *Thorax*. Antepronotum with a few broad silvery scales. *Legs* (Fig. 17). Posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III unequal, simple. *Abdomen*. Tergum I with a lateral band of silvery-white scales on laterotergite; terga III-VII with basal bands of white scales; segment VIII removed with terminalia and coloration lost. *Genitalia* (Fig. 37). Tergum IX slightly bilobed with 3-4 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad with short bristles scattered over dorsal surface, long stout bristles along outer lateral margin from base to apex, ventral surface with long stout bristles on distal 0.55, most numerous along sternomesal margin, scattered short ones on proximal 0.45, scattered scales on lateral and ventral surfaces; gonostylus with pedicel narrow to moderately broad, distal 0.50 expanded with a lateroapical horn-like flap bearing numerous short fine hairs, mesal margin of expanded portion with a basal short, flattened pigmented gonostylar claw and 4-5 short accessory claws, 4-6 moderately long bristles at apex, 3-8 short hairs on the tergal surface;

basal mesal lobe short and rounded apically, apical 0.30 with 4-5 short bristles, a long narrow lightly pigmented filament extending from apex to near base of gonostylus and attached to mesal membrane of gonocoxite, entire surface of basal portion covered with short hair-like spicules; proctiger short, paraproct with a small subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.50 and covered with a dorsal flap, paramere long, approximately 0.90 length of lateral plates; sternum IX large, entire surface covered with minute spicules, 4 bristles near the center.

PUPA and LARVA. Not known.

TYPE DATA. There are 1 male and 1 female syntypes of *Aedes lowisii* in the British Museum (Natural History). The syntype female of *Aedes (Aedimorphus) lowisii* is hereby designated lectotype and bears the following data: *Reedomyia lowisii* Theobald, *Andaman Islands*, INDIA, Lowis. The male syntype (only the genitalia in a drop of balsam on a plastic square attached to the pin with the data labels remains) is hereby designated as allolectotype and bears the same data as the lectotype female. *Aedes (Aedimorphus) mindoroensis* Knight and Hull, holotype male and 4 paratype females, Calapan (erroneously printed "Calopan" on label), *Mindoro Island*, PHILIPPINES, 1 February 1916, Bottcher, in British Museum (Natural History).

I have compared the types of *lowisii* and *mindoroensis* and cannot find any apparent differences, therefore I am placing *mindoroensis* in synonymy to *lowisii*.

DISTRIBUTION. Specimens examined--3 males and 20 females from the following locations:

AUSTRALIA. *N.E. New Guinea*, Morobe, Lae.

INDIA. *Andaman Islands*.

INDONESIA. *Celebes*, Paloe, Hadjene; *Moluccas*, Morotai; C. Sulawesi, Lambarese; *Ambon*, Paso.

PHILIPPINES. *Mindoro*, Calapan.

Other distribution.

INDONESIA. *Sumatra* (Brug 1926: 529).

MALAYSIA. *Sarawak* (Moulton 1914: 47).

The record of *lowisii* from Ceylon by Theobald (1910b: 260) was based on a misidentification and should be for *jamesi* (Barraud 1934: 250) and the record from this country by Senior-White (1927: 69) should be for *pipersalatus* (Carter and Wijesundara 1948: 141).

TAXONOMIC DISCUSSION. The adult habitus and female and male genitalia of *lowisii* are very similar to *alboscutellatus* and are discussed under that species. The most distinctive features of the adults are: scutellum with broad silvery scales on each lobe; postspiracular area without scales; subspiracular area with only short fine hairs; paratergite bare; tarsi banded with pale scales, tarsomere 5 yellow scaled; and female with 1 large and 2 rudimentary seminal capsules.

BIOLOGY. Larvae were collected in shallow water in a primary forest and adults were taken biting man and resting in a cowshed in Celebes (larval information on adult labels). Adults were also collected from a Malaise trap in Indonesia.

AEDES (AEDIMORPHUS) MEDIOLINEATUS (THEOBALD)
(Figs. 5, 16, 17, 22, 33, 38, 52, 63)

Culex trilineatus Theobald 1901, Monogr. Cul. 2: 105 (♀*); Giles 1902, Handb. 2nd Ed., p. 464 (♀); Blanchard 1905, Moust., p. 330 (♀); Theobald 1905, Genera Insec., Fasc. 26: 27; Theobald 1910, Monogr. Cul. 5: 359; Brunetti 1912, Rec. Indian Mus. 4: 476.

Culex mediolineatus Theobald 1901, Monogr. Cul. 2: 113 (♀); Giles 1902, Handb., 2nd Ed., p. 431(♀); Blanchard 1905, Moust., p. 369(♀); Theobald 1905, Genera Insec. Fasc. 26: 27; Brunetti 1907, Rec. Indian Mus. 1: 349.

Ochlerotatus mediolineatus Theo., Edwards 1913, Bull. ent. Res. 4: 228; Brunetti 1920, Rec. Indian Mus. 17: 137; Senior-White 1923, Cat. Indian Insects, Cul., p. 79.

Aedes (Ecculex) mediolineatus Theobald, Edwards 1922b, Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) mediolineatus (Theo.), Barraud 1928, Indian J. med. Res. 15: 665 (♂*, ♀); Stone et al. 1959, Thomas Say Found. 6: 194; Kurihara 1965, Jap. J. sanit. Zool. 16: 21(A*).

Aëdes (Aëdimorphus) mediolineatus Theo., Borel 1930, Coll. Soc. Path. exot. Monogr. 3: 268 (♂*, ♀, L*); Edwards 1932, Genera Insec., Fasc. 194: 171.

Aëdes (Aëdimorphus) mediolineatus (Theobald), Barraud 1934, Fauna Brit. India, Diptera 5: 263 (♂*, ♀).

FEMALE (Fig. 5). *Head.* Antenna dark brown, approximately 0.94 length of proboscis, pedicel pale with a few small brown scales and a patch of short fine brown hairs mesally, flagellomere 1 with a few small pale brown scales; clypeus brown, bare; maxillary palpus golden scaled, approximately 0.22 length of proboscis; proboscis golden scaled with apical 0.25 dusky, approximately 1.22 length of femur I; vertex with dorsum covered with narrow curved decumbent golden scales; lateral surface covered with broad golden scales, some specimens also with a small anterodorsal dark spot; numerous golden-brown erect forked scales on occiput and vertex extending anteriorly to ocular line, erect scales somewhat darker on lateral margins of occiput. *Thorax.* Scutal integument reddish-brown; scutum covered with narrow curved reddish-brown scales, narrow curved white scales forming a pair of stripes on dorsocentral areas extending from anterior scutal fossal area to scutellum, similar scales on supra-alar areas from scutal angle to posterior of wing base and on anterior and lateral margins of prescutellar space (scales nearly covering this area), narrow curved golden scales forming a stripe on acrostichal area extending from median anterior promontory area to posterior medial scutal area; scutellum with a patch of narrow curved golden scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 3-5 lateral, 2-3 median and 1-2 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles golden-brown and well developed; pleural integument light brown; antepronotum covered with narrow curved golden-white scales, several golden bristles; postpronotum covered with narrow curved scales, a few reddish-brown ones dorsally and remainder golden-white, 6-8 golden bristles; propleuron with long moderately broad and narrow golden-white scales, several golden bristles; postspiracular area with a patch of narrow curved and a few moderately broad golden-white scales, 7-10 golden bristles; subspiracular

area with a small patch of narrow curved golden-white scales; mesepisternum with an upper and a posterior patch of broad golden-white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with a few narrow golden-white scales, several golden bristles; paratergite covered with narrow curved golden-white scales; mesepimeron with a patch of broad golden-white scales and several golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several golden bristles, I, II each with anterior surface covered with broad golden-white scales, III with a few anteroventral golden-white scales; trochanters I-III each with broad white scales; femora I-III each with a small dorsoapical spot of white scales, I with anterior surface white with a few intermixed light brown scales ventrally, II with anterior surface brown with a few white scales intermixed on apical 0.25, III with anterior surface white with an anterodorsal brown stripe on distal 0.75, stripe broader apically, I-III with posterior surfaces white, I with a ventral brown stripe from near base to apex, II with a few pale brown scales on distal 0.25, III with a triangular patch of brown scales on dorsoapical 0.20; tibiae I-III white, I with a dorsoanterior longitudinal brown stripe, II with a ventral longitudinal brown stripe, III with a dorsal and a ventral longitudinal brown stripe and a small dorsoapical white spot; tarsi I-III brown, I with an anterior and a posterior longitudinal white stripe on tarsomeres 1-2, occasionally on 3, II with tarsomere 1 with numerous white scales intermixed with brown ones and a dorsobasal white spot, tarsomere 2 with a few white scales intermixed with brown ones, tarsomeres 1-3 with a posterior longitudinal white stripe and occasionally on tarsomere 4, III with a dorsobasal white spot on tarsomere 1, an anterior and a posterior longitudinal white stripe on tarsomere 1 and basal 0.50 of tarsomere 2; posttarsi I-III each with 2 ungues I, II equal, each bearing a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with broad whitish scales along basal 0.33 of its posterior margin; dusky scales on subcosta; ventral veins brown with white scales along basal 0.33 of posterior margin of costa, similar scales on basal 0.33 of subcosta; alula with narrow brown scales along fringe; 2 remigial bristles. *Halter*. Pedicel pale, capitellum golden-white scaled. *Abdomen*. Tergum I covered with golden-white scales, laterotergite with a rectangular patch of whitish scales; terga II-VI light brown, each with a broad median longitudinal golden-white stripe and a narrower longitudinal golden-white stripe on lateral margins, V, VI often with brown areas reduced; tergum VII covered with golden scales; sterna covered with golden-white scales; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 22). Tergum VIII index 0.96-1.29; sternum VIII index 0.82-1.08; tergum IX bilobed with 7-16 bristles on each lobe, index 1.13-1.50; insula tongue-like, covered with minute setae and with 4-6 small tuberculi on apical 0.25; lower vaginal lip narrow, moderate to heavily pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 5-10 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.96-1.26, ventral PGL index 2.07-2.31; cercus moderately long, 1.00 extended from segment VII, narrow, apex rounded, numerous bristles on dorsal and lateral surfaces, index 2.54-2.76, cercus/dorsal PGL index 3.59-4.11; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 5). Similar to female in general habitus. *Head*. Maxillary palpus golden scaled, segments 2-5 each with a small dorsoapical brown

spot, longer than proboscis by 0.50 length of apical segment. *Thorax.* Postspiracular area without scales; subspiracular area with a few broad white scales. *Legs* (Fig. 17). Posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple. *Abdomen.* Tergum I white with a median brown scale patch, laterotergite with a patch of whitish scales; terga II-VII brown each with a dorsobasal triangular patch of golden-white scales on lateral margins, reaching from base to apex, VII often nearly entirely golden scaled; tergum VIII white scaled; sterna golden-white scaled, VIII with a median patch of brown scales. *Genitalia* (Fig. 38). Tergum IX strongly bilobed with 6-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad with short bristles scattered over entire dorsal surface, lateral surface with long stout bristles from base to apex, ventral surface with long stout bristles on distal 0.45, scattered moderately long bristles mesally below long ones, somewhat more numerous along sternomesal margin, scattered scales on lateral and ventral surfaces; gonostylus with pedicel moderately broad, distal 0.50 expanded with a lateroapical horn-like flap bearing a short fine subterminal hair, mesal margin of expanded portion with a moderately long, flattened, pigmented gonostylar claw and a short fine hair near its base, 3 short fine hairs along apex and 3-5 short fine hairs scattered over tergal surface, a lateroapical thumb-like process covered with numerous short fine hair-like spicules; basal mesal lobe short and rounded apically, apical 0.50 with 4-6 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.40 and covered with a dorsal flap, paramere long, approximately 0.85 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 2-3 bristles near the center.

PUPA (Fig. 52). Chaetotaxy as figured and recorded in Table 4. *Cephalothorax.* Hair 5-C with 3-5 branches; 7-C with 2-5 branches; 8-C with 2-6 branches. *Respiratory trumpet.* Moderately pigmented; index 3.74-4.56, average 4.25. *Metanotum.* Hair 10-C with 11-24 branches; 12-C with 4-5 branches. *Abdomen.* Hair 5-I with 8-17 branches; 1-II with 17-28 branches; 4-II with 6-10 branches; 1-III with 7-18 branches; 6-VI with 2-4 branches; 1-VII with 3-6 branches; 6-VII with 8-12 branches; 9-VII with 5-11 branches; 11-VII single to triple. *Paddle.* Ovoid; with very minute serrations along basal 0.55 of outer margin; midrib does not reach apex; hair 1-P short, single or double; index 1.10-1.35, average 1.26.

LARVA (Fig. 63). Chaetotaxy as figured. *Head.* Hairs 1, 3, 14-C single; 4, 12-C with 5-9(6) branches; 5, 6-C with 4-6(5) branches; 7-C with 8-11(10) branches; 8-C double or triple (2); 9, 10-C double or triple (3); 11-C with 3-6(5) branches; 13-C with 3-5(3) branches; 15-C with 2-5(3) branches; basal maxillary hair single; mental plate with 22-23(23) teeth. *Antenna.* Heavily pigmented; numerous stout spicules scattered over shaft, longer at about middle; hair 1-A with 6-13(8) branches, inserted at 0.36-0.48 from base; 2-A long; 3-A approximately equal in length of 2-A. *Thorax.* Hair 0-P with 6-12(7) branches; 1, 5, 6, 10, 12-P single; 2-P single or double (2); 3-P with 3-4(4) branches; 4, 8, 9-P double; 7-P triple; 11-P double or triple (2); 14-P single or double (1); 1-M with 2-5(2) branches; 2-M single or double (2); 3, 11-M single or double (1); 4-M with 2-4(3) branches; 5, 7, 10, 12-M single; 6-M with 5-10(8) branches; 8-M with 6-12(7) branches; 9-M with 6-9(8) branches;13-M with 3-6(5) branches; 14-M with 6-10(9) branches; 1-T single to triple (1); 2-T with 2-5(3) branches; 3-T with 6-11(8) branches; 4-T with 3-4(3)

branches; 5, 10-T single; 6-T single or double (2); 7-T with 8-14(11) branches; 8-T with 3-6(4) branches; 9-T with 6-9(6) branches; 11, 12-T single or double (1); 13-T with 5-14(7) branches. *Abdomen.* Hairs 0, 14-VIII single; 1-VIII with 4-9(5) branches; 2, 4-VIII double or triple (2); 3-VIII with 8-18(15) branches; 5-VIII with 8-11(10) branches; 6-V-VI short; comb with 9-19(15) scales arranged in 2 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins; 1-X with 3-4(4) branches; 2-X with 12-15(14) branches; 3-X single; ventral brush varies from 8 hairs on grid and 4 precratal ones to 9 hairs on grid and 3 precratal ones, usually with 8 hairs on grid and 4 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin and small ridges over entire saddle, acus present; 4 anal papillae, very long and slender. *Siphon.* Moderately pigmented with minute ridges over entire surface; acus present; index 5.93-7.01; pecten with 10-14(12) teeth, apical 3-4 teeth smooth and wider spaced than remainder which have a slender apical attenuated filament with 1-2 lateral denticles; hair 1-S with 5-7(5) branches, inserted at 0.72-0.78 from base.

EGG (Fig. 33). *Shape.* Fusiform; greatest diameter near middle. *Size.* Length 735-840 microns; width 190-200 microns. *Color.* Brown. *Chorion.* Reticulation on entire egg composed of polygonal cells of varied size; cell walls raised. *Remarks.* The description of the egg is based on 5 mature eggs extracted from the abdomen of a museum specimen which possessed the following collection data on the labels: THAILAND, Lampang Province, Wat Luang, 15 May 1968, collection number 02699, collector Bruce A. Harrison and genitalia preparation number T72.137.

TYPE DATA. *Culex mediolineatus* Theobald, holotype female, Thayetmyo, BURMA, August, E. Y. Watson, 94-4 and *Culex trilineatus* holotype female with same data as holotype of *mediolineatus*, both in British Museum (Natural History).

DISTRIBUTION. Specimens examined--142 males, 329 females, 82 pupae, 181 larvae and 93 individual rearings (50 pupal, 43 larval) from the following locations:

BURMA. Thayetmyo.

CAMBODIA. Phnom-Penh.

MALAYSIA. *Perlis*; *Kedah*.

SOUTH VIETNAM. *Bihn Dinh*, An Khe, Long Van, Qui Nhon, Vinh Thanh; *Bien Hoa*, Di An; *Da Nang*, Da Nang; *Gia Dinh*, Saigon, Tan San Nhut; *Hau Nghia*, Cu Chi; *Khanh Hoa*, Nha Trang; *Kontum*, Kontum; *Nha Trang*, Ben Kay; *Ninh Thuan*, Phan Rang; *Tay Ninh*, Phuoc Vinh; *Thua Thien*, Cu Lai; Pho Bai, Phu Loi.

THAILAND. *Chiang Mai*, Ban Lang Ka, Ban Mae Yuak, Chang Kien, Chang Puak, Chiang Mai, Doi Sutep, Muang, Thanou Doi Saket; *Chon Buri*, Bang Huai Kum, Bang Phra, Khao Phai; *Khon Kaen*, Ban Muang Kao, Ban Nong Kham, Phu Wiang; *Lampang*, Wat Luang; *Nakhon Ratchasima*, Banna Nabon, Pak Chong; *Nan*, Ban Huai Hap; *Prachuap Khiri Khan*, Tubsakea; *Surat Thani*, Ban Taling Ngam, Ko Samui; *Udon Thani*, Ban Kau Noi, Tai Tan Kam Phoo, Muang.

Other distribution.

CHINA. *Hainan Island* (Chu 1957: 158, 1958: 109).

INDONESIA. *Sumatra*, Djambi, Moeara Tebo (Brug and Edwards 1931: 258); *Java* (Barraud 1934: 264).

THAILAND. Nakhon Phanom, Takhli, Ubon (Parrish 1968b: 2); Don Muang AB, U-Tapao AB (Reisen et al. 1971: Tables 7 and 8).

SOUTH VIETNAM (Borel 1930: 268); Phan Rang, Phu Cat, Pleiku (Parrish 1968a: 3); Bien Hoa (Parrish 1969: 554); Cam Ranh Bay (Reisen et al. 1971: Table 12); Cam Khe, Khe Sahn, Khue Bac, Kim Lien, Nui Dat (Grothaus et al. 1971: 20).

TAXONOMIC DISCUSSION. *Aedes mediolineatus* and *trilineatus* were both originally described by Theobald (1901a) in volume I of *A Monograph of the Culicidae of the World*. *Aedes trilineatus* had page priority but the name is preoccupied.

Aedes mediolineatus is similar in the adult habitus to *pallidostriatus*. It possesses the following features: wing with anterior margin of costa dark brown scaled; femur II with anterior surface mainly dark scaled and anterior surface of femur III mainly white scaled; abdomen with dorsolateral longitudinal brown bands on terga II-IV; and postpronotum with 6-7 bristles, which distinguish it from *pallidostriatus* which has: wing with anterior margin of costa golden scaled; femora II-III each with anterior surface brown with a median longitudinal white stripe from base to apex; and abdomen with terga completely golden scaled. The gonostylus of the male genitalia of *mediolineatus* is markedly different from that of *pallidostriatus*.

The pupa of *mediolineatus* has a very similar chaetotaxy to *pallidostriatus* and it is difficult to separate them. They usually can be separated by abdominal hair 1-I which has 17-30 branches in *mediolineatus* and 30-46 branches in *pallidostriatus*.

There are no apparent differences between the larva of *mediolineatus* and *pallidostriatus*.

BIOLOGY. Immatures have been collected from a wide range of habitats but the preferred site appears to be fresh water flood pools with floating and submerged dead leaves or abundent floating and emergent vegetation located in secondary scrub or plains areas. Adults have been taken feeding on man and domestic animals. Immatures in Thailand have been collected usually from small and large flood pools, occasionally from large rice fields, and also from edge of large pond, Huey Keo City moat, small animal footprint, large pit and large wheeltrack; usually from colored fresh water but also numerous times from turbid fresh and clear fresh water; water usually with floating and submerged dead leaves or abundant floating and emergent vegetation; in partial shade or unshaded areas; usually in rice fields or pools in plains, but also from secondary scrub and coconut groves in plains, and secondary scrub in hills and mountains; and at an altitude from 43 to 1, 580 feet (most often from 80 to 650 feet). Larvae were collected in association with the following species of mosquitoes: *Aedes alboscutellatus, caecus, culicinus, ferinus, lineatopennis, vexans vexans; Anopheles barbirostris, kochi, maculatus, philippinensis, vagus;* and *Culex annulus, fuscanus, fuscocephalus, gelidus, mimulus, pseudovishnui, raptor, tritaeniorhynchus, whitmorei.* Adults have been taken biting man, cattle and horses, resting in a stable and a house, and in a light trap.

In South Vietnam larvae were collected from ground pools, tire, artificial container, ditch, marshy depression, flood pools, swamp, rock pools, wheel track, footprints and a rice field and adults were taken in light traps.

Macdonald (1957: 21) obtained specimens of *mediolineatus* that he identified as *Aedes (Aedimorphus)* species near *pallidostriatus* from human bait collections in Malaysia. Adults were taken feeding on bovines and chickens (unpublished data from SEATO Medical Research Laboratory Annual Progress Report 1967: 450) and collected in scrub or open forest at 1, 000 feet in Thailand (Scanlon and Esah 1965: 139, 143). Grothaus et al. (1971: 20) collected

larvae from standing pools with emergent vegetation, rice paddies, dense swamps and borrow pits and adults from indoor resting sites, light traps and CO_2 traps.

AEDES (AEDIMORPHUS) NIGROSTRIATUS (BARRAUD)
(Figs. 6, 16, 23, 39)

Aëdimorphus nigrostriatus Barraud 1927, Indian J. med. Res. 14: 549 (♂*, ♀).
Aedes (Aedimorphus) nigrostriatus Barr., Barraud 1928, Indian J. med. Res. 15: 666 (♂*, ♀).
Aëdes (Aëdimorphus) nigrostriatus Barraud, Edwards 1932, Genera Insec., Fasc. 194: 171; Barraud 1934, Fauna Brit. India, Diptera 5: 262 (♂*, ♀).
Aedes (Aedimorphus) nigrostriatus (Barraud), Stone et al. 1959, Thomas Say Found. 6: 195.

FEMALE (Fig. 6). *Head.* Antenna brown, approximately 1.04 length of proboscis, pedicel pale with a few small yellow scales and a patch of short fine brown hairs mesally, flagellomere 1 pale with a few small yellow scales; clypeus light brown, bare; maxillary palpus golden scaled, approximately 0.25 length of proboscis; proboscis golden scaled with a small ventrobasal patch of brown scales, approximately 1.04 length of femur I; vertex with dorsum covered with narrow curved decumbent yellow scales; lateral surface covered with broad pale yellow scales; numerous light brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument pale with dark reddish-brown areas forming a pair of stripes on dorsocentral areas from anterior margin to scutellum and a spot on supra-alar area anterior to wing base; scutum covered with narrow curved golden scales with narrow curved reddish-brown ones on dark areas of integument; scutellum with a patch of narrow curved golden scales on each lobe and a few reddish-brown ones on laterobasal areas of median lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 4-5 lateral, 1-2 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles pale brown and well developed; pleural integument light brown; antepronotum with narrow curved golden scales, several golden-brown bristles; postpronotum with narrow curved golden scales, 3-5 golden-brown posterior bristles; propleuron with broad golden scales, several golden bristles; postspiracular area with a few narrow golden scales, 5-7 golden bristles; subspiracular area with a small patch of moderately broad golden scales; mesepiternum with a small upper and a posterior patch of broad golden scales, several upper and posterior golden-brown bristles, lower ones white and shorter; prealar knob with several golden bristles; paratergite with a few narrow golden scales; mesepimeron with a patch of broad golden scales and several golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several golden-brown bristles, I, II each with anterior surface covered with broad golden scales, III with a small anteroventral patch of similar scales; trochanters I-III each with broad golden scales; femora I-III golden, I with a narrow posteroventral longitudinal brown stripe from base to near apex, II with a broad anterobasal longitudinal brown stripe from base to apical 0.20 and a narrow anterior subapical brown band, III with a narrow anterior and posterior subapical brown band; tibiae I-III yellow, II with an indistinct anteroventral longitudinal brown stripe on

basal 0.50; tarsi I-III yellow; posttarsi I-III each with 2 ungues, I, II equal, each with a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad golden scales except for the following brown scaled areas: apical 0.25 of costa pale brown; remigium and basal 0.50 of radius (a few yellow scales on posterior margin), apical 0.50 of radial sector, $radius_2$ and basal 0.50 of $radius_3$; media from radiomedial crossvein to furcation, basal 0.60 of $media_1$,and cubitus; membrane darkened in region of crossveins; ventral veins with scaling similar to dorsal ones except subcosta and remigium completely golden scaled; alula with narrow yellow scales along fringe; 1-2 remigial bristles. *Halter*. Pedicel pale, capitellum golden scaled. *Abdomen*. Terga golden scaled, I with a rectangular patch of white scales on laterotergite, II-VII each with a laterobasal white scale patch; sterna golden scaled; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 23). Tergum VIII index 1.01-1.11; sternum VIII index 0.78-0.88; tergum IX bilobed with 5-8 bristles on each lobe, index 0.78-0.81; insula tongue-like, covered with minute setae and with 4-6 small tuberculi on apical 0.25; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderate to heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 5-7 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.97-1.03, ventral PGL index 2.04-2.10; cercus moderately long, 0.75-0.85 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 2.08-2.28, cercus/dorsal PGL index 3.32-3.71; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 6). Similar to female in general habitus. *Head*. Maxillary palpus golden with apical segment brown, segment 4 golden dorsally and brown laterally, segments 2-3 each with a narrow apical brown band, longer than proboscis by 0.75 length of apical segment; proboscis golden with a longitudinal brown stripe on basal 0.40 of ventral surface. *Legs*. Femur I also with an anteroventral brown stripe on basal 0.50; tibia III with an indistinct dorsal brown stripe; tarsus I with a few light brown apical scales on tarsomeres 3-4; posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple. *Abdomen*. Terga yellow scaled; sterna yellow scaled with a few brown scales on lateral surfaces of III, VI, a few brown scales along posterior margins of VI, VII. *Genitalia* (Fig. 39). Tergum IX bilobed with 5-7 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with several short scattered hairs, mainly along tergomesal margin and a few moderately long bristles on distal 0.25, lateral surface with a number of long stout bristles from base to apex, ventral surface with a number of moderately long to long bristles on distal 0.33 and a few scattered short proximal ones, a row of 6-8 long stout bristles along distal 0.50 of sternomesal margin, scattered scales on lateral and ventral surfaces; gonostylus with distal 0.62 expanded into a large mesal oblong-shaped lobe and a lateral longer, narrow, strongly incurved, tapering horn which bears a ventral patch of long thin hairs mesally near middle, mesal expanded lobe with 2-3 laterobasal short fine hairs, a small mesal indentation with a curved pigmented claw attached, 3 short fine hairs apically, a patch of long hair-like spicules proximad of claw and an additional patch on tergal surface; basal mesal lobe short and narrow, distal 0.40 with 3 moderately long and 1 short bristle, entire surface covered with short hair-like spicules; proctiger short, paraproct with a small subapical

thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 8-9 short blunt lateral teeth on distal 0.50 and covered with a dorsal flap, paramere long, approximately 0.78 length of lateral plate; sternum IX large, entire surface covered with minute spicules, bristles absent.

PUPA and LARVA. Not known.

TYPE DATA. There are 1 male and 1 female syntypes of *Aedes nigrostriatus* in the British Museum (Natural History) and each bears the following data: *Aedimorphus nigrostriatus* Barraud, Golaght, *Assam*, INDIA, 17 November 1925, Capt. P. J. Barraud, caught in jungle. Lectotype designation is hereby made for the syntype male and allolectotype designation is made for the syntype female. One paratype male and 1 paratype female, with same data as lectotype, are in the Indian Museum, Calcutta.

DISTRIBUTION. Specimens examined--2 males and 6 females from the following locations:

BURMA. *Pegu*, Rangoon.

INDIA. *Assam*, Chabua, Golaghat.

TAXONOMIC DISCUSSION. *Aedes nigrostriatus* resembles *Aedes trimaculatus* but can be separated from this species by the ornamentation and integument color of the scutum. In *nigrostriatus* the scutal integument is pale with dark reddish-brown areas forming a pair of stripes on the dorsocentral areas and a circular spot on the supra-alar area anterior to the wing base, while *trimaculatus* has the scutal integument reddish-brown with the scutal fossal areas and prescutellar space pale. The color of the scutal scales is the same as the underlying integument on these 2 species. *Aedes nigrostriatus* also has the wing membrane darkened in regions of the crossveins while all other Oriental species of *Aedimorphus* do not have this feature.

BIOLOGY. Larvae were collected from muddy pools in India (data on adult labels).

Females in a freshly-fed condition have been collected from cowsheds in India (Barraud 1927: 551).

AEDES (AEDIMORPHUS) ORBITAE EDWARDS
(Figs. 7, 16, 17, 24, 40, 53, 64)

Lepidotomyia Taeniata Leicester 1908, Cul. Malaya, p. 133 (♂, ♀); Brunetti 1912, Rec. Indian Mus. 4: 459.

Ochlerotatus taeniatus Leices., Brunetti 1920, Rec. Indian Mus. 17: 140.

Aedes orbitae Edwards 1922a (*nom nov*), Indian J. med. Res. 10: 260.

Aedes (Ecculex) orbitae Edwards 1922b (*nom nov* for *taeniata* Leicester, *non* Wiedemann 1928), Indian J. med. Res. 10: 466.

Aëdes (Aëdimorphus) orbitae Edw., Edwards and Given 1928, Bull. ent. Res. 18: 344(L); Edwards 1932, Genera Insec., Fasc. 194: 168; Edwards *in* Barraud 1934, Fauna Brit. India, Diptera 5: 250 (♂, ♀).

Aedes (Aedimorphus) orbitae Edwards, Stone et al. 1959, Thomas Say Found. 6: 195.

FEMALE (Fig. 7). *Head.* Antenna dark brown, approximately 1.06 length of proboscis, pedicel pale brown with a few small brown scales and a patch of short fine dark brown hairs mesally, flagellomere 1 pale with a few small brown scales; clypeus dark brown, bare; maxillary palpus dark brown scaled with apex silvery-white, occasionally a few white scales on base of

segment 4, approximately 0.19 length of proboscis; proboscis dark brown scaled with a white ventral spot extending onto lateral surfaces approximately 0.67 from base (occasionally this spot forms a complete band), approximately 1.04 length of femur I; vertex with dorsum covered with narrow curved decumbent scales arranged in an anteromedian diamond-shaped dark brown group and the remainder golden-white; lateral surface covered with broad white scales, an anterodorsal black patch and a dark area anterior to antepronotum; numerous brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax*. Scutal integument brown; scutum covered with narrow curved reddish-black scales, narrow curved white scale patches on median anterior promontory area, scutal fossal areas (extending from anterior area along margin and onto lateral area), small circular patch on posterior scutal fossal area, supra-alar area above posterior of paratergite, similar scales along anterior margin of scutal ridge from scutal angle posteromesally 0.50 to dorsocentral area and scattered over area mesally to dorsocentral setae; scutellum with a patch of broad overlapping silvery-white scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 4-5 lateral and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument dark brown; antepronotum covered with narrow curved white scales, several dark bristles; postpronotum sparsely covered with narrow curved scales, reddish-black ones dorsally and a few posteriorly with a patch of white ones mesally, 6-7 posterior dark bristles; propleuron with a patch of broad silvery-white scales, several golden bristles; postspiracular area with 4-7 golden bristles; mesepisternum with an upper and a lower patch of broad silvery-white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with several golden-brown bristles; paratergite with broad silvery-white scales on lateral surface; mesepimeron with a patch of broad silvery-white scales and golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several brown bristles, I with anterior and lateral surfaces covered with broad brown scales with a dorsal white patch, II, III each with a patch of broad white scales on anterior surface; trochanters I-III each with broad white scales; femora I-III each brown, with a narrow basal white band and a dorsoapical silvery-white spot, I with a narrow anteroventral white stripe on basal 0.33 in some specimens, III with an anteroventral longitudinal white stripe from base to apex, I-III each with posterior brown, I with a posterodorsal white stripe from base to apex, II, III each with a posteroventral white stripe, broad basally and tapering to apex; tibiae I-III brown, each with a few ventrobasal pale scales, I with a dorsoapical silvery-white spot, III with a few lateroapical silvery-white scales, I with a posteroventral longitudinal white stripe from base to apex, II, III each with a posteromedian longitudinal white stripe, II with stripe from base to near apex, III with stripe on apical 0.65 (stripe on III absent or reduced in some specimens); tarsi I-III brown, I with tarsomeres 2, 3 each with a dorsobasal white spot, II with tarsomeres 1-3 each with a dorsobasal white spot, a few dorsoapical white scales on tarsomere 1, III with tarsomeres 1-4 each with a broad basal white band, and a few dorsoapical white scales, tarsomere 5 white scaled; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with a patch of white scales at base; ventral veins brown scaled; alula with narrow brown scales along fringe; 2 remigial bristles. *Halter*. Pedicel pale, capitellum white scaled with a few brown scales at base. *Abdomen*. Tergum I brown with a rectangular patch of silvery-white scales on

laterotergite; terga II-VII brown dorsally (a few basomedian pale scales on II-IV in some Malayan specimens), each with a lateromedian white scale patch, sometimes extending to base along lateral margins on III-VII; sterna white scaled with a brown posterior band on sterna II-VI; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 24). Tergum VIII index 0.89-1.08; sternum VIII index 0.78-0.88; tergum IX bilobed with 5-8 bristles on each lobe, index 0.93-0.95; insula tongue-like, covered with minute setae and with 3-5 small tuberculi on apical 0.25; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a deep median indentation, 4-8 bristles on each side of midline, covered with minute setae, dorsal PGL index 1.14-1.26, ventral PGL index 1.93-1.96; cercus moderately long, completely extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 2.50-2.81, cercus/dorsal PGL index 3.18-3.21; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 7). Similar to female in general habitus. *Head.* Maxillary palpus brown with segments 3-5 each with a basal white band, segment 2 with a dorsal white spot near middle, longer than proboscis by length of apical segment; proboscis with median white spot forming a band; vertex with median narrow brown scaled stripe reduced. *Legs* (Fig. 17). Tibia III without posteromedian white stripe; posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple. *Abdomen.* Terga III-VII each with a basomedian patch of white scales in addition to lateromedian white patches (basomedian patches small in some specimens), patch small on VII; tergum VIII and sternum VIII completely white scaled. *Genitalia* (Fig. 40). Tergum IX strongly bilobed with 6-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with short fine hairs along tergomesal margin and a few moderately long bristles at median forming somewhat of a longitudinal line on basal 0.50, short bristles on remainder of area, lateral margin with long stout bristles from base to apex, ventral surface with long stout bristles on distal 0.45, most numerous on sternomesal margin, scattered short to moderately long bristles over remainder of area, scattered scales on lateral and ventral areas; gonostylus with pedicel long, narrow and somewhat incuved, distal 0.38 expanded into a mesal lobe and a lateral, narrow, incurved, apically pointed horn attached approximately 0.78 from base with a short fine hair at apex, mesal expanded lobe with a moderately long, flattened, curved, and apically blunt gonostylar claw attached mesally near middle, 3-5 long stout bristles along apical margin, mesal 1-2 bristles shorter and others equal in length, 3 short fine hairs along mesal margin of distal 0.30 of pedicel; basal mesal lobe short and rounded apically, distal 0.50 with 12-14 short bristles; entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 4-5 short blunt lateral teeth on distal 0.60 and covered with a dorsal flap, paramere long, approximately 0.89 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 5-10 bristles near center.

PUPA (Fig. 53). Chaetotaxy as figured and recorded in Table 5. A patch of spicules on metanotum between hairs 12-C and one on abdomen between hairs 1-I. *Cephalothorax.* Hair 5-C with 3-6 branches; 7-C with 3-5 branches; 8-C with 7-9 branches. *Respiratory trumpet.* Lightly pigmented;

index 3.30-4.06, average 3.67. *Metanotum*. Hair 10-C with 17-33 branches; 12-C with 5-10 branches. *Abdomen*. Hair 5-I with 7-16 branches; 1-II with 33-65 branches; 4-II with 3-6 branches; 1-III with 8-17 branches; 6-VI single; 1-VII with 3-6 branches; 6-VII with 6-11 branches; 9-VII with 4-6 branches; 11-VII single. *Paddle*. Ovoid; with very minute serrations along basal 0.55 of outer margin; midrib does not reach apex; hair 1-P short, single; index 1.05-1.32, average 1.17.

LARVA (Fig. 64). Chaetotaxy as figured. *Head*. Median mouth brushes pectinate apically; hairs 1, 3, 14-C single; 4-C with 7-13(10) branches; 5-C with 6-9(8) branches; 6, 13-C with 6-9(7) branches; 7-C with 9-16(13) branches; 8-C double or triple (2); 9-C with 2-4(3) branches; 10-C double or triple (3); 11-C with 5-8(5) branches; 12-C with 5-10(8) branches; 15-C with 3-5(4) branches; basal maxillary hair single; mental plate with 27-29(28) teeth. *Antenna*. Lightly pigmented; scattered small spicules over entire shaft, more numerous on basal 0.50; hair 1-A with 3-5(4) branches, inserted at 0.49-0.52 from base; 2-A long; 3-A approximately 0.34 length of 2-A. *Thorax*. Hair 0-P with 9-21(15) branches; 1, 5, 6, 10, 12-P single; 2, 9, 11, 14-C double or triple (2); 3, 7-P with 3-4(3) branches; 4-P single to triple (2); 8-P double or triple (3); 1-M with 3-8(5) branches; 2-M single to triple (2); 3, 5, 7, 10, 12-M single; 4-M with 3-6(4) branches; 6-M with 5-9(7) branches; 8-M with 7-11(8) branches; 9, 14-M with 6-10(7) branches; 11-M single or double (1); 13-M with 5-10(6) branches; 1, 12-T single to triple (1); 2-T with 3-6(5) branches; 3-T with 8-18(11) branches; 4-T with 2-5(3) branches; 5, 10-T single; 6-T double or triple (2); 7-T with 8-13(10) branches; 8-T with 4-8(6) branches; 9-T with 5-8(6) branches; 11-T single or double (1); 13-T with 5-11(9) branches. *Abdomen*. Hairs 1, 2-VIII on common basal plate; hairs 0, 14-VIII single; 1-VIII with 6-10(7) branches; 2-VIII double or triple (3); 3-VIII with 13-27(15) branches; 4-VIII single to triple (1); 5-VIII with 6-10(9) branches; 6-V-VI short; comb with 20-30(27) scales arranged in 3 irregular rows, scales moderately long and rounded apically with stout denticles on lateral margins and apex; 1, 3-X single; 2-X with 8-14(9) branches; ventral brush varies from 9 hairs on grid and 3 precratal ones to 10 hairs on grid and 2 precratal ones, usually with 10 hairs on grid and 2 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment (covers approximately 0.50 of segment), with numerous spicules along posterior margin and small ridges over entire saddle, acus absent; 4 anal papillae, long and slender, tapering to an apical point. *Siphon*. Moderately pigmented with minute ridges over entire surface; with a small dorsoapical and ventroapical patch of spircules (patches do not join on lateral surface); a large patch of spicules on lateral surface near middle; acus absent; index 3.40-4.67; pecten with 18-22(18) teeth, apical 2-3 teeth smooth or with a very tiny median denticle and wider spaced than remainder which have a slender apical attenuated filament with 1-3 lateral denticles; hair 1-S with 4-7(5) branches, inserted 0.80-0.85 from base.

TYPE DATA. There are 2 male and 4 female syntypes of *Aedes orbitae* in the British Museum (Natural History). Lectotype female of *Aedes (Aedimorphus) orbitae* is hereby designated and bears the following data: *Lepidotomyia taeniata* Leicester, Kuala Lumpur, FED. MALAY STATES, 6 February 1903, Dr. G. F. Leicester, *Culex Alboscutellata* var. *Annul*, bred larvae from muddy water in rut made by wagon wheel in wagon track into jungle 5 3/4 miles Pakang Rd., Kuala Lumpur; allolectotype male is also hereby designated and bears the following data: same as lectotype except var. *Annul* absent and date is 25 February 1903; 1 paralectotype male with same data as allolectotype; 2 paralectotype females with same data as lectotype except one has date of 8 February

1903; and 1 paralectotype female with the following data: *Culex trifeliat*, 31 January 1903, taken on wagon rd., high patch jungle Pahang Rd. 5 3/4 miles, remainder of data same as lectotype. There are in the United States National Museum (Natural History) an additional male and a female syntypes with the same data as the lectotype except the date is 8 February 1903. These 2 specimens are hereby designated paralectotypes.

DISTRIBUTION. Specimens examined--63 males, 69 females, 84 pupae, 128 larvae and 84 individual rearings (53 pupal, 31 larval) from the following locations:

MALAYSIA. *North Borneo*, Forest Camp, Kalabakan, Ta Waw; *Pahang*, Chegar Perah, Gunong Benom; *Perak*, Chior F. R.; *Perlis*, Bt. Bintang F. R.; *Sabah*, Tenom; *Selangor*, Kota Belud, Kuala Lumpur, Sabak Ulu Gombak.

SINGAPORE.

THAILAND. *Nakhon Si Thammarat*, Ban Rim Thanon, Chang Khao, Thung Song; *Narathiwat*, Khau Lau; *Phangnga*, Kh. Pak Chaung, Nam Tai; *Prachin Buri*, Ban Thap Lan; *Ranong*, Kraburi; Yala, Kg. Yala Bong.

Other distribution.

SINGAPORE. Gunong Pulai (Edwards 1928: 344).

TAXONOMIC DISCUSSION. *Aedes orbitae* resembles *jamesi* and *lowisii* in the adult habitus. It can be easily distinguished from these species by the bare subspiracular area, shape of the gonostylus of the male genitalia and presence of 1 large and 2 slightly smaller seminal capsules in the female genitalia. The male genitalia of *orbitae* are similar to *caecus* and *punctifemoris*. It is easily separated from these two species by having 12-14 bristles on the basal mesal lobe while *caecus* has 5-8 bristles and *punctifemoris* has 4-6 bristles. Other distinctive features of the adults are: scutellum with broad silvery scales on each lobe; postspiracular area without scales; and tarsi banded with white scales, tarsus III with tarsomere 5 white scaled.

The pupa is characterized by the following features: trumpet broad; hair 10-C with 17-33 branches; hair 1-II with 33-65 branches; hair 7-V long and single; and hairs 10-IV, V long and single.

The larva resembles *caecus* from which it can be separated by: a lateral patch of spircules at about middle of siphon; hairs 1, 2-VIII on common basal plate; and hair 6-C with 6-9 branches, while *caecus* has: a dorsal and ventral patch of spicules near middle of siphon; hairs 1, 2-VIII not on a plate; and hair 6-C with 4-5 branches. Other distinctive features of *orbitae* are: hair 4-C with 7-13 branches; hair 13-C with 6-9 branches; hairs 13-III-V well developed; and comb with 20-30 scales.

BIOLOGY. The immatures are usually collected from shaded elephant footprints and small flood pools containing turbid fresh water located in primary and secondary forests in mountainous areas. Adults have been taken biting man. Immatures in Thailand have been collected from large elephant footprints, small animal footprints, large flood pool, small ditch and small stream pool; usually in turbid fresh water but occasionally in clear fresh water; water with floating and submerged vegetation or with scarce aquatic vegetation; usually in partial shade but occasionally in heavy or unshaded areas; usually in primary and secondary rain forests in mountains, occasionally in rubber plantations in hilly areas and secondary rainforest in the plains; and at an altitude of 7 to 2,300 feet (most often from 200 to 500 feet). Larvae were collected in association with the following species of mosquitoes: *Aedes caecus, macfarlanei; Anopheles balabacensis, barbirostris, hackeri, introlatus, kochi, maculatus, montanus, riparis, subpictus; Culex bitaeniorhynchus, mimulus;* and *Uranotaenia bicolor*. Adults were taken biting man.

In Malaysia, larvae were collected from temporary pools on muddy ground in inland forests and adults taken biting man by Macdonald (1957: 21). In this country, Macdonald and Traub (1960: 100) also obtained immatures from cart tracks and hoofprints and Leicester (1908: 134) collected larvae from ruts in a jungle wagon track.

AEDES (AEDIMORPHUS) PALLIDOSTRIATUS (THEOBALD)
(Figs. 8, 16, 17, 25, 41, 54, 65)

Culex pallidostriatus Theobald 1907, Monogr. Cul. 4: 410 (♂*, ♀); Brunetti 1912, Rec. Indian Mus. 4: 473.

Culex parascelos Theobald 1910, Rec. Indian Mus. 4: 18 (♀); Theobald 1910, Monogr. Cul. 5: 379; Brunetti 1912, Rec. Indian Mus. 4: 473.

Ochlerotatus ochraceus Theo., Edwards 1911, Bull. ent. Res. 2: 250 (Oriental records only).

Ochlerotatus pallidostriatus (Theo.), Edwards 1913, Bull. ent. Res. 4: 228; Brunetti 1920, Rec. Indian Mus. 17: 140.

Aedes (Ecculex) pallidostriatus Theobald, Edwards 1922b, Indian J. med. Res. 10: 467.

Ochlerotatus pallidostriatus Theobald, Senior-White 1923, Cat. Indian Insects, Cul., p. 81.

Aedes (Aedimorphus) pallidostriatus (Theo.), Barraud 1928, Indian J. med. Res. 15: 665 (♂*, ♀); Stone et al. 1959, Thomas Say Found. 6: 196; Qutubuddin 1960, Mosquito News 20: 358 (♂).

Aëdes (Aëdimorphus) pallidostriatus Theobald, Edwards 1932, Genera Insec., Fasc. 194: 171.

Aëdes (Aëdimorphus) pallidostriatus (Theobald), Barraud 1934, Fauna Brit. India, Diptera 5: 261 (♂*, ♀, L*).

FEMALE (Fig. 8). *Head.* Antenna dark brown, approximately 0.91 length of proboscis, pedicel pale with a few small dusky scales and a patch of short fine brown hairs mesally, flagellomere 1 pale with a few small pale scales; clypeus pale, bare; maxillary palpus golden scaled with short dark brown bristles, approximately 0.20 length of proboscis; proboscis golden scaled with apical 0.25 dusky, approximately 1.11 length of femur I; vertex with dorsum covered with narrow curved golden decumbent scales; lateral surface covered with broad golden-white scales; numerous golden erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument light reddish-brown; scutum covered with narrow curved bronzy scales, narrow curved whitish-golden scales forming a pair of stripes on dorsocentral areas from anterior scutal fossal areas to scutellum and a less distinct stripe on acrostichal area from anterior promontory area to posterior medial scutellar area, similar scales covering supra-alar area from scutal angle to posterior of wing base, posterior medial scutal area and prescutellar space; scutellum with narrow curved whitish-golden scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-4 lateral, 1-3 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-brown and well developed; pleural integument golden-brown; antepronotum covered with narrow curved golden scales, numerous golden bristles; postpronotum covered with narrow curved golden scales, 9-10 golden bristles; propleuron with narrow curved golden scales, numerous golden

bristles; postspiracular area with a patch of narrow curved golden scales, 7-8 golden bristles; subspiracular area with a patch of narrow curved golden scales; mesepisternum with an upper patch of moderately broad golden scales; a posterior patch of broad golden scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with a few narrow curved golden scales, several golden bristles; paratergite with narrow curved golden scales on lateral and ventral surfaces; mesepimeron with a patch of broad golden scales and numerous golden bristles on upper area; other areas bare. *Legs* (Fig. 16). Coxae I-III each with several golden bristles and a patch of moderately broad golden-white scales, I with scales on anterior and lateral surfaces, II with scales on anterior surface, III with a small anteroventral patch; trochanters I-III each with a patch of broad white scales; femur I with anterior surface white with an indistinct median longitudinal brown stripe, posterior surface white with a ventral longitudinal brown stripe from base to apex; femora II, III with anterior surface brown, each with a median longitudinal white stripe from base to apex, stripe broader on III and completely covers basal 0.25, II, III with posterior surface white with a few brown scales forming an indistinct stripe on apical 0.25; tibiae I-III each white with a dorsal and a ventral longitudinal brown stripe from base to apex; tarsi I-III brown each with an anteromedian and a posteromedian longitudinal white stripe on tarsomeres 1-3 and occasionally on tarsomeres 4 of II, III; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad scales; costa and subcosta covered with golden scales with a few brown scales along posterior margin of costa (anterior always golden scaled); radius, cubitus and anal veins each with a few golden scales intermixed with brown scales on basal 0.65; remainder of veins brown scaled; remigium golden scaled with brown scales along anterior margin; ventral veins brown scaled with basal 0.75 of costa and basal 0.50 of radius covered with golden scales; alula with narrow golden-brown scales along fringe; 2 golden remigial bristles. *Halter*. Pedicel pale, capitellum white scaled. *Abdomen*. Terga and sterna covered with golden scales and with numerous golden bristles, mostly along posterior margins; tergum I with a rectangular patch of golden-white scales on laterotergite. *Genitalia* (Fig. 25). Tergum VIII index 1.27-1.38; sternum VIII index 0.98-1.04; tergum IX bilobed with 6-12 bristles on each lobe, index 1.13-1.23; insula tongue-like, covered with minute setae and with 3-6 small tuberculi on apical 0.25; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderate to heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a small median indentation, 6-10 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.90-1.02, ventral PGL index 2.03-2.22; cerci moderately long, 0.75-0.90 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 2.38-2.54, cercus/dorsal PGL index 3.32-3.71; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 8). Similar to female in general habitus. *Head*. Maxillary palpus golden scaled with a dorsoapical brown spot on segment 2, longer than proboscis by length of apical segment. *Thorax*. Postspiracular area without scales. *Legs* (Fig. 17). Posttarsi I-III each with 2 ungues, I, II with

ungues unequal, each bearing a tooth, III unequal, simple. *Abdomen.* Terga brown, I with a few dorsomedian golden scales, II-VI each with a narrow golden basal band and a dorsomedian stripe not reaching posterior margins of terga, a few lateral golden scales on VI-VII, VII golden with a pair of admedian brown patches, VIII golden scaled; sterna golden scaled. *Genitalia* (Fig. 41). Tergum IX strongly bilobed with 7-8 bristles on each lobe, entire surface covered with minute spircules; gonocoxite long and moderately broad, dorsal surface, except tergomesal margin, covered with short thin bristles, lateral surface covered with long stout bristles from base to apex, ventral surface with a few long stout bristles at apex, distal 0.40 with moderately long stout bristles becoming very numerous on sternomesal margin, remainder of area with scattered short bristles, scattered scales on lateral and ventral surfaces; gonostylus with pedicel very short and broad, distal 0.67 expanded into a large mesal lobe and a lateral narrow, slightly longer, incurved, tapered horn attached approximately 0.67 from base, mesal expanded lobe with lateral margin concave, apex broad and flat with 3 short hairs near lateral margin and 2 similar ones near mesal margin, mesal margin of lobe with a small apical concave area bearing a short, strongly curved, pigmented gonostylar claw, a short fine hair near base of claw and a patch of moderately long hair-like spicules along mesal margin proximad from base of claw, 3 short fine hairs dorsally near middle of lobe; basal mesal lobe short and rounded apically, distal 0.50 with 5-6 short thin bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 4 short blunt lateral teeth on distal 0.58 and covered with a dorsal flap, paramere long, approximately 0.95 length of lateral plate; sternum IX large, entire surface covered with minute spircules, 6-7 bristles near center.

PUPA (Fig. 54). Chaetotaxy as recorded in Table 6. *Cephalothorax.* Hair 5-C with 3-6 branches; 7-C double or triple; 8-C with 2-6 branches. *Respiratory trumpet.* Moderately pigmented; index 4.25-4.81, average 4.52. *Metanotum.* Hair 10-C with 10-18 branches; 12-C with 3-7 branches. *Abdomen.* Hair 5-I with 8-15 branches; 10-11-I single, present or absent; 1-II with 9-36 branches; 4-II with 5-9 branches; 1-III with 7-18 branches; 6-VI double or triple; 1-VII with 5-9 branches; 6-VII with 8-13 branches; 9-VII with 3-8 branches; 11-VII single to triple. *Paddle.* Ovoid; with very minute serrations along basal 0.60 of outer margin; midrib does not reach apex; hair 1-P short, single; index 1.24-1.70, average 1.40.

LARVA (Fig. 65). Chaetotaxy as figured. *Head.* Hairs 1, 3, 14-C single; 4-C with 6-7(7) branches; 5, 6-C with 4-6(5) branches; 7-C with 5-12(7) branches; 8, 10-C double or triple (2); 9, 13-C double or triple (3); 11-C with 3-6(4) branches; 12-C with 3-5(5) branches; 15-C single or double (2); basal maxillary hair single; mental plate with 24-27(27) teeth. *Antenna.* Moderately to heavily pigmented; numerous stout spicules scattered over shaft, those near and distad of middle longer; hair 1-A with 7-14(9) branches inserted 0.43-0.47 from base; 2-A long; 3-A approximately equal in length to 2-A. *Thorax.* Hair 0-P with 4-8(5) branches; 1, 5, 6, 10, 12, 14-P single; 2, 8-P double or triple (2); 3-P double or triple (3); 4, 11-P single to triple (2); 7-P triple; 9-P single or double (2); 1-3-M with 2-4(3) branches; 5, 7, 10, 12-M single; 6-M with 5-7(6) branches; 8-M with 5-8(8) branches; 9-M with 4-8(6) branches; 11-M single or double (1); 13-M with 5-8(6) branches; 14-M with 6-10(7) branches; 1, 11, 12-T single or double (1); 2-T with 3-4(3) branches; 3-T with 5-10(6)

branches; 4-T with 2-6(3) branches; 5, 10-T single; 6-T single to triple (2); 7-T with 7-12(9) branches; 8-T with 4-7(5) branches; 9-T with 6-8(6) branches; 13-T with 5-9(5) branches. *Abdomen.* Hairs 0, 14-VIII single; 2-VIII with 4-5(4) branches; 2-VIII single to triple (2); 3-VIII with 8-17(14) branches; 4-VIII double or triple (2); 5-VIII with 7-10(7) branches; 6-V-VI short; comb of 14-20(16) scales arranged in 2 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1-X with 2-4(2) branches; 2-X with 9-13(12) branches; 3-X single; ventral brush with 8-9 (usually 9) hairs on grid and 3 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with small spicules along posterior margin, acus absent; 4 anal papillae, very long and slender, tapering to an apical point. *Siphon.* Moderately pigmented with minute ridges over entire surface; acus very small; index 6.50-7.91; pecten with 10-14(10) teeth, apical 6-7 teeth smooth, apical 3-4 wider spaced than remainder which have a slender apical attenuated filament with 1-2 lateral denticles near middle; hair 1-S with 5-6(5) branches, inserted 0.72-0.77 from base.

TYPE DATA. There are 1 male and 1 female syntypes of *Aedes pallidostriatus* in the British Museum (Natural History) and each bears the following data: *Culex pallidostriatus* Theobald, INDIA, S. Christophers. Lectotype designation is hereby made for the syntype male and allolectotype designation is made for the syntype female. The holotype female of *Culex parascelos* Theobald bears the following data: Madras Town, *Madras,* INDIA, 30 October 1908, and is in the Indian Museum (Barraud 1928: 665, 1934: 261).

DISTRIBUTION. Specimens examined--12 males, 25 females, 5 pupae, 23 larvae and 6 individual larval rearings from the following locations:

CEYLON. Hambantota, Kapitigalla, Kurunegala, Peradeniya, Trincomali.

INDIA. *Bengal,* Tezgaon, Tinpahar near Rajmahal; *Bihar,* Pusa; *Bombay Deccan,* Belgaun; *Madras,* Madras; *Punjab,* Karnal; *United Provinces,* Anwarganj.

THAILAND. *Nanchanaburi,* Ban Sai Yok.

WEST PAKISTAN. *Lahore,* Shah Zada.

Other distribution.

BANGLADESH (East Pakistan). *Dinajpur,* Thakurgaon, Akcha, Madarganj (Aslamkhan and Wolfe 1971: 31).

CEYLON (Chow et al. 1954: 117); *North-Western Province,* Bandarakoswatte, Magulagama; *Western Province,* Colombo (Carter 1948: 313, 315).

CHINA (Feng 1958: 62).

INDIA. *Bengal,* Dum Dum, Cuttack, Delhi, Manhupar, Trombay, Bombay Harbour (Barraud 1928: 665); *Mardas,* North Arcot (Reuben 1971: 120).

MALAYSIA. *Kedah,* Kampong Bukit Kechik; *Negri Sembilan,* Port Dickson, Pulau Mertajam (McDonald 1957: 21).

THAILAND. Chaingmai (Thurman and Thurman 1955: 222).

WEST PAKISTAN. *Kohat,* Kohat-Hangu Valley (Qutubuddin 1960: 358).

TAXONOMIC DISCUSSION. *Aedes pallidostriatus* is similar in adult habitus and pupal and larval chaetotaxy to *mediolineatus* and is discussed under that species. The male terminalia of these 2 species can be separated from each other by the shape of the gonostylus.

BIOLOGY. Larvae were collected in India from ground pools. Adults were taken biting cattle and larvae from rice fields in West Pakistan. In Ceylon, larvae were collected from paddy fields and adults in a Malaise trap at an elevation of 10 feet.

In India, Barraud (1934: 262) found the immatures in open pools formed

by rain and seepage, water filled dikes, ditches and borrow pits. Aslamkhan and Wolfe (1971: 31) collected adults resting in a house, biting cattle and biting humans in India. Carter (1948: 314), working in Ceylon, collected adults from a cattle baited trap.

AEDES (AEDIMORPHUS) PAMPANGENSIS (LUDLOW)
(Figs. 9, 16, 17, 26, 42, 55, 66)

Reedomyia Pampangensis Ludlow 1905, Can. Ent. 37: 94 (♀).
Reedomyia niveoscutella Theobald 1905, J. econ. Biol. 1: 22 (♀*); Theobald 1907, Monogr. Cul. 4: 259 (♂*, ♀); Theobald 1910, Monogr. Cul. 5: 253.
Reedomyia niveoscutellata Theob., Brunetti 1907, Rec. Indian Mus. 1: 362; Brunetti 1912, Rec. Indian Mus. 4: 487.
Reedomyia pampangensis Ludlow, Brunetti 1907, Rec. Indian Mus. 1: 362; Theobald 1907, Monogr. Cul. 4: 258 (♀); Theobald 1910, Monogr. Cul. 5: 253; Brunetti 1912, Rec. Indian Mus. 4: 487; Stone and Knight 1956, J. Wash. Acad. Sci. 46: 223.
Ochlerotatus niveoscutellatus Theob., Brunetti 1920, Rec. Indian Mus. 17: 139; Senior-White 1923, Cat. Indian Insects, Cul., p. 80.
Ochlerotatus pampangensis Ludl., Brunetti 1920, Rec. Indian Mus. 17: 140.
Aedes (Ecculex) alboscutellatus Theobald, Edwards 1922b, *(in part)*, Indian J. med. Res. 10: 467; Edwards 1932 *(in part)*, Genera Insec., Fasc. 194: 167.
Aedes (Ecculex) niveoscutella Theobald, Edwards 1922b, Indian J. med. Res. 10: 467.
Aëdes (Aëdimorphus) niveoscutella Theobald, Dyar and Shannon 1925, Insecutor Inscit. menstr. 13: 76; Edwards 1932, Genera Insec., Fasc. 194: 168; Barraud 1934, Fauna Brit. India, Diptera 5: 251 (♂, ♀).
Aedes (Aedimorphus) niveoscutella (Theo.), Barraud 1928, Indian J. med. Res. 15: 659 (♀).
Aëdes (Aëdimorphus) alboscutellatus Theobald, Edwards 1932 *(in part)*, Genera Insec., Fasc. 194: 167.
Aedes (Aedimorphus) pampangensis (Ludlow), Bohart 1945, U. S. Navmed. 580, p. 53 (♂, ♀); Knight and Hull 1953, Pacif. Insects 7: 454 (♂*, ♀, L*); Stone et al. 1959, Thomas Say Found. 6: 196.
Aedes (Aedimorphus) niveoscutellum (Theobald), Stone et al. 1959, Thomas Say Found. 6: 195. NEW SYNONYM.

FEMALE (Fig. 9). *Head.* Antenna brown, approximately 1.10 length of proboscis, pedicel pale with a patch of short fine brown hairs mesally (a few small brown scales also present on specimens from India), flagellomere 1 pale with a few small brown scales; clypeus light brown, bare; maxillary palpus golden-brown scaled, approximately 0.19 length of proboscis; proboscis golden-brown scaled with apical 0.25 darker, ventral surface slightly paler (entirely golden scaled in specimens from India), approximately equal in length to femur I; vertex with dorsum covered with narrow decumbent scales, anterior 0.25 brownish and the remainder white; lateral surface covered with broad white scales and with an anterodorsal dark patch; numerous golden-brown erect forked scales on occiput and vertex extending anteriorly to the ocular line. *Thorax.* Scutal integument reddish-brown; scutum covered with narrow curved pale reddish-brown scales, narrow curved white

scales forming small patches on median anterior promontory area, anterior scutal fossal area and supra-alar area from scutal angle to wing base; scutellum completely covered with overlapping broad silvery-white scales; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-4 lateral, and 1 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument pale brown; antepronotum covered with narrow curved white scales, several long golden to dark bristles; postpronotum covered with narrow curved scales, anterior and dorsal ones pale reddish-black, remainder white, 6-7 dark posterior bristles; propleuron with a patch of broad white scales, several long golden bristles; postspiracular area with a patch of broad white scales, 6-7 golden bristles; subspiracular area with a small patch of narrow curved white scales; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior long golden bristles, lower 8-10 bristles shorter; prealar knob with numerous golden bristles; paratergite with narrow curved white scales along lateral and ventral margins; mesepimeron with a patch of broad white scales and numerous pale golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several pale golden bristles, I with anterior surface covered with broad white scales and a few light brown ones laterally, II with anterior surface covered with broad white scales, III with a small anterodorsal and an anteroventral patch of broad white scales; trochanters I-III each with a patch of broad white scales; femora I-III each with a dorsoapical white spot, I, II with anterior surface brown, III with anterior surface pale and dorsoapical 0.30 brown, I with dorsal 0.75 of posterior surface pale and remainder brown, II, III each with basal 0.60 of posterior surface pale and remainder light brown dorsally; tibiae I, II pale, I with an anterior longitudinal brown stripe, II with a ventral longitudinal brown stripe, III brown with an anterior and a posterior pale longitudinal stripe; tarsi I, II brown each with a posteroventral longitudinal pale stripe on tarsomere 1 and basal 0.50 of tarsomere 2, II also with a small elongated dorsobasal pale spot; tarsus III brown occasionally with a posteroventral longitudinal pale stripe on tarsomere 1; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, 1 bearing a tooth. *Wing*. Dorsal veins covered with brown moderately broad scales; costa with a few pale scales at base and along its posterior margin at the humeral cross vein; ventral veins brown scaled with pale scales on basal 0.25 of subcosta and a few on posterior of costa; alula with narrow brown scales along fringe; 2-4 remigial bristles. *Halter*. Pedicel pale brown, capitellum white scaled. *Abdomen*. Terga brown dorsally; tergum I with a few pale scales dorsally (some specimens with tergum I all brown dorsally) and a rectangular patch of white scales on laterotergite; terga III, IV each with a small basomedian pale scale patch; tergum V with a basomedian pale stripe extending 0.50 posteriorly and a few pale scales along posterior margin; tergum VI with a median triangular pale scale patch extending from base to posterolateral margins; tergum VII with basomesal pale scales; terga II-VI each with a broad longitudinal pale band on lateral surfaces; (some specimens from India and the Philippines also with the following: VI with more pale scales posteriorly and VII nearly completely pale scaled; sterna pale scaled); terga and sterna with numerous golden-brown bristles, mostly along posterior margins. *Genitalia* (Fig. 26). Tergum VIII index 1.22-1.44; sternum VIII index 1.01-1.10; tergum IX bilobed with 5-8 bristles on each lobe, index 1.17-1.58; insula tongue-like, covered with minute setae and with 4-6 small tuberculi on apical 0.25; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip

narrow, moderately to heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderately pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 6-10 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.98-1.48, ventral PGL index 2.45-3.29; cercus long, 0.70-0.80 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 3.48-3.63, cercus/dorsal PGL index 3.74-4.79; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 9). Similar to female in general habitus. *Head.* Maxillary palpus brown with a broad lateral patch of pale scales near base of segment 2, longer than proboscis by 0.50 length of apical segment; vertex without anterodorsal dark scale patch. *Thorax.* Postspiracular area without scales. *Legs* (Fig. 17). Tarsi I, II each with posteroventral longitudinal pale stripe usually reduced to basal 0.75 of tarsomere 1; posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple. *Abdomen.* Terga I-VII brown, each with a narrow indistinct longitudinal pale stripe on lateral surfaces; tergum VIII with a large laterobasal pale scale patch. *Genitalia* (Fig. 42). Tergum IX bilobed with 5-8 bristles on each lobe, entire surface covered with minute spicules; gonocoxite moderately long and broad, dorsal surface with a median patch of long stout bristles from near base to apex, somewhat shorter and thinner bristles laterad and extending over lateral margin from base to apex; tergomesal margin with a dense patch of short, somewhat flattened, curved bristles near middle, a number of short thin bristles distad and a few proximad of patch, ventral surface covered with scattered short bristles and long stout ones on distal 0.30, long bristles more numerous on sternomesal margin, scattered scales on lateral and ventral surfaces; gonostylus with pedicel very short and broad, distal 0.80 greatly expanded with a laterotergal flap-like structure bearing 2 dense lateral patches of very long thin hairs near middle and numerous short fine hairs extending to apex which terminates in a small incurved pigmented point, remainder of expanded portion concave dorsally with a short, flat, apically tapering gonostylar claw attached mesally approximately 0.80 from base, 4 smaller accessory claws along apical margin, numerous short fine hairs forming a large patch on tergal and sternal surfaces; basal mesal lobe short and rounded apically, distal 0.55 with 2-3 short stout apical bristles and 2-3 short fine ones, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 6-7 short blunt lateral teeth on distal 0.57 and covered with a dorsal flap, paramere long, approximately 0.98 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 5-7 bristles near center.

PUPA (Fig. 55). Chaetotaxy as figured and recorded in Table 7. *Cephalothorax.* Hair 5-C with 6-9 branches; 7, 8-C with 8-11 branches. *Respiratory trumpet.* Moderately pigmented; index 4.53-5.20, average 4.89. *Metanotum.* Hair 10-C with 13-16 branches; 12-C with 3-11 branches. *Abdomen.* Hair 5-I with 10-18 branches; 1-II with 24-40 branches; 4-II with 6-11 branches; 1-III with 10-16 branches; 6-VI with 6-8 branches; 1-VII with 7-10 branches; 6-VII with 7-14 branches; 9-VII with 5-7 branches; 11-VII with 2-4 branches. *Paddle.* Ovoid; with very minute serrations along basal 0.50 of outer margin; midrib does not reach apex; hair 1-P short, single or double; index 1.18-1.25, average 1.22.

LARVA (Fig. 66). Chaetotaxy as figured. *Head.* Hairs 1, 3, 14-C single; 4-C with 5-7(6) branches; 5-C with 5-8(6) branches; 6-C with 4-7(5)

branches; 7-C with 8-13(10) branches; 8-C with 2-4(3) branches; 9-C with 2-5(3) branches; 10-C single or double (2); 11-C with 3-6(4) branches; 12-C with 3-6(5) branches; 13, 15-C with 2-4(2) branches; basal maxillary hair single; mental plate with 32-34(33) teeth. *Antenna*. Moderately pigmented; numerous stout spicules scattered over shaft, more numerous near middle; hair 1-A with 6-11 branches, inserted 0.35-0.42 from base; 2-A long; 3-A approximately 0.50 length of 2-A. *Thorax*. Hair 0-P with 5-12(6) branches; 1, 5, 6, 10, 12-P single; 2-P double or triple (2); 3, 7-P double or triple (3); 4, 9, 11-P with 2-4(3) branches; 8, 14-P double; 1-M with 3-4(4) branches; 2-M with 2-4(3) branches; 3-M with 2-5 branches; 4-M with 4-6(4) branches; 5-M double or triple (3); 6-M with 3-6(4) branches; 7, 10, 12-M single; 8-M with 7-10(8) branches; 9-M with 7-10(7) branches; 11-M single or double (1); 13-M with 5-12(6) branches; 14-M with 7-11(7) branches; 1, 5, 10, 11-T single; 2-T with 4-7(5) branches; 3-T with 17-28(17) branches; 4-T with 3-6(3) branches; 6-T double or triple (3); 7-T with 6-11(7) branches; 8-T with 5-7(5) branches; 9-T with 5-8(8) branches; 12-T single to triple (2); 13-T with 9-14(9) branches. *Abdomen*. Hairs 0, 14-VIII single; 1-VIII with 4-9(7) branches; 2-VIII with 2-5(3) branches; 3-VIII with 8-13(12) branches; 4-VIII with 2-4(3) branches; 5-VIII with 5-8(8) branches; 6-IV-VI short; comb with 18-23(20) scales arranged in 3 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1-X double or triple (2); 2-X with 10-15(14) branches; 3-X single; ventral brush with 9-10 (usually 9) hairs on grid and 3 precratal ones; saddle lightly pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus present; 4 anal papillae, long, each broad at base and tapering to a pointed apex. *Siphon*. Lightly pigmented with minute ridges; acus present; index 7.50-9.00; pecten with 15-18(15) teeth, apical 3-4 teeth larger, smooth and wider spaced than remainder which have a long slender apical attenuated filament with 1-2 basal denticles; hair 1-S with 4-5(4) branches, inserted 0.69-0.74 from base.

TYPE DATA. *Reedomyia Pampangensis* Ludlow, 3 syntype females, Angeles, Pampanga, *Luzon*, PHILIPPINES, September, Dr. Eugene R. Whitmore, caught in the woods and in the quarters, types non-existent (Stone 1970: 151). There is one specimen in the United States National Museum (Natural History) which bears labels with the following data: *Reedomyia pampangensis* Ludlow, Camp Wm. McKinley, Rizal, P. I., Oct. 25, Nov. 3, 05, Type; Type No. 27795 U.S.N.M. The first label is in Ludlow's handwriting, but since the specimen was collected after date of publication (March 1905) of the original description, it cannot be considered as the type. No other type material of *pampangensis* was found. Knight and Hull (1953: 454) considered the above specimen as the type but later Stone and Knight (1956: 223) indicated it could not be the type since it was collected after publication of the name. Since the type material of *pampangensis* has been lost and this species has a superficial resemblance to several other species of *Aedimorphus* as well as occurring in a wide range in the Oriental Zoogeographical Region I am hereby designating an adult female as neotype for the species. The preceeding written description and following habitus illustrations of the female are of the neotype (a comparison to specimens from other areas in its geographical range is also made). In the taxonomic discussion of the species some diagnostic characters for distinguishing *pampangensis* from closely related species is given. The neotype is deposited in the United States National Museum (Natural History), Washington, D. C., and bears labels with the following information: Sison, Pangasinan, *Luzon*, P. IDS., April 1945, J. G. Franclemont; NEOTYPE, *Aedes (Aedim.) pampangensis*, Det: J. F. Reinert. *Reedomyia niveoscutella* Theobald, holotype female, INDIA,

Capt. James, in British Museum (Natural History).

I have compared the neotype of *pampangensis* to the holotype of *niveoscutellum* and cannot find any apparent differences; therefore I am placing *niveoscutellum* in synonymy to *pampangensis*.

DISTRIBUTION. Specimens examined--29 males, 107 females, 11 pupae and 29 larvae from the following locations:

INDIA. *Bihar*, Pusa, Sharma.

INDONESIA. *Sumatra*, Atjeh, Kroeng Raja.

PHILIPPINES. *Luzon*, Calaccad, Nunoz Necija, Olongapo; *Camarines Sur; Leyte*, Mahaplag; *Mindanao*, Pasananco, Pettit Barracks, Zamboanga; *Mindoro*, San Jose; *Pampanga*, Camp Stotsenberg, Clark Air Force Base; *Pangasinan*, Camp Gregg, Sison, Tayng; *Rizal*, Camp Nichols, N. Ecija; *Zambales*, Subic Bay.

SOUTH VIETNAM. *Binh Dinh*, An Khe.

THAILAND. Surasthani.

Other distribution.

INDIA. *Purneah*, Kierpur (Barraud 1928: 660).

INDONESIA. *Sumatra*, Atchin (Brug and Edwards 1931: 258); Lokop, Bireuen (Brug and Haga 1923: 639; Haga 1924: 830); *Java* (Barraud 1934: 252).

PHILIPPINES. *Manila*, Quezon City; *Zamboanga*, Pettit Barracks, San Ramon City, Zamboanga (Knight and Hull 1953: 457); *Pampanga*, Angeles (Ludlow 1905: 95): *Pampanga*, Dau; *Zambales*, Olongapo (Basio 1971: 11); Clark AB (Dowell, Libay and Baisas 1965: 14).

SOUTH VIETNAM. Binh Thuy, Phan Rang, Pleiku (Parrish 1968a: 3, 4, Parrish 1969: 554); Cam Ranh Bay (Reisen et al. 1971: Table 12).

THAILAND. Nakhom Phanon, U-Tapao (Reisen et al. 1971: Tables 4 and 8).

TAXONOMIC DISCUSSION. *Aedes pampangensis* has a somewhat superficial resemblance to *mediolineatus* and *pallidostriatus* in the pleural scale markings but is distinguished from these species by the presence of broad silvery-white scales on the scutellum and the absence of longitudinal white stripes on the scutum. The broad silvery-white scales on the scutellum is also reminiscent of *alboscutellatus* and its relatives, but *pampangensis* is easily separated from these species by the absence of dorsal spots on the scutum and the abdominal terga which lack dorsobasal pale bands and are completely white scaled laterally. The gonostylus of the male genitalia of *pampangensis* is greatly expanded and very distinctive when compared to other members of the subgenus.

The description and illustration by Borel (1930: 267) attributed to the male of *pampangensis* (= *niveoscutellum*) was not of this species but was probably *alboscutellatus*.

The pupa of *pampangensis* is distinctive in having abdominal hair 1-I-VIII well developed, hair 1-C with 5-8 branches, 4-C with 6-8 branches, 7-C with 8-11 branches, 5-II with 10-14 branches, 6-IV, V with 5-8 branches and 6-VI with 6-8 branches.

The larva of *pampangensis* resembles those of *mediolineatus* and *pallidostriatus* in having a very long siphon but can be separated from these 2 species by mesothoracic hair 5-M which is double or triple and metathoracic hair 3-T which has 17-28 branches while *mediolineatus* and *pallidostriatus* have hair 5-M single and 3-T with 5-11 branches.

BIOLOGY. Immatures appear to prefer unshaded, grassy flood pool habitats containing fresh water. Adults have been taken feeding on cattle. In Thailand immatures have been collected from small flood pools and large

wheel tracks, with turbid fresh water occasionally containing scarce emergent aquatic vegetation, no shade, located in teak plantations in the plains and in a primary bamboo grove in the mountains, and at altitudes from 400 to 635 feet. Larvae were collected in association with the following mosquitoes: *Aedes andamensis, culicinus, gubernatoris, imprimens, pipersalatus, vittatus* and *Anopheles kochi*. In the Philippines immatures were collected from a grassy pond, road canal, rice field, small flooded area near road, grassy ground pool, and along the shaded bank of a clear water stream containing algae and vegetation. In West Pakistan, adults were taken biting cattle.

Larvae were collected from scattered rain pools in a grassy area and from a grassy pool in the bed of a temporary stream in the Philippines by Knight and Hull (1953: 457).

AEDES (AEDIMORPHUS) PIPERSALATUS (GILES)
(Figs. 10, 16, 17, 27, 43, 56, 67)

Stegomyia pipersalata Giles *in* Theobald 1901, Monogr. Cul. 2: 316 (♂, ♀); Giles 1902, Handb., 2nd Ed., p. 372 (♀*); Blanchard 1905, Moust., p. 264 (♀); Brunetti 1907, Rec. Indian Mus. 1: 332; Theobald 1910, Monogr. Cul. 5: 607; Brunetti 1912, Rec. Indian Mus. 4: 448.

Pseudograbhamia maculata Theobald 1905, J. Bombay nat. Hist. Soc. 16: 243 (♂, ♀); Brunetti 1907, Rec. Indian Mus. 1: 140; Theobald 1907, Monogr. Cul. 4: 314 (♂, ♀*); Brunetti 1912, Rec. Indian Mus. 4: 460.

Ochlerotatus pipersalatus (Giles), Edwards 1913, Bull. ent. Res. 4: 227 (♂, ♀); Brunetti 1920, Rec. Indian Mus. 17: 138; Senior-White 1923, Cat. Indian Mus, Cul., p. 81.

Aedes (Ecculex) pipersalatus Giles, Edwards 1922b, Indian J. med. Res. 10: 467.

Aedes (Aedimorphus) pipersalatus (Giles), Barraud 1928, Indian J. med. Res. 15: 664; Stone et al. 1959, Thomas Say Found. 6: 196; Qutubuddin 1960, Mosquito News 20: 358 (♂).

Aëdes (Aëdimorphus) pipersalatus Giles, Edwards 1932, Genera Insec., Fasc. 194: 170.

Aëdes (Aëdimorphus) pipersalatus (Giles), Barraud 1934, Fauna Brit. India, Diptera 5: 258 (♂*, ♀, L*).

FEMALE (Fig. 10). *Head.* Antenna dark brown, approximately equal to length of proboscis, pedicel brown with a few small dusky scales and a patch of short fine brown hairs mesally, flagellomere 1 pale basally with a few small dusky scales; clypeus dark, bare; maxillary palpus brown scaled with apical 0.25 white, apical hairs also white, approximately 0.18 length of proboscis; proboscis brown scaled dorsally with a few intermixed white scales, white ventrally from near base to distal 0.25, approximately 1.26 length of femur I; vertex with dorsum covered with narrow curved decumbent scales arranged in an anteromedian diamond-shaped brown group and the remainder white; broad white scales extending halfway down lateral surface with broad brown ones below and also forming an anterodorsal patch; numerous dark brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument dark brown; scutum covered with narrow curved reddish-black scales; narrow curved white scales forming small circular patches on median anterior promontory area, scutal fossal areas (one each on anterior, lateral and posterior areas), scutal angle, supra-alar area

(a patch anterior to and a small indistinct spot posterior to wing base and a patch medially near dorsocentral setal line), posterior medial scutal area and extending posteriorly along lateral margins of prescutellar space, similar scales scattered over area mesally to dorsocentral setae; scutellum with a patch of broad and a few narrow curved white scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 2-4 lateral, 1-2 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed; pleural integument dark brown; antepronotum with narrow curved white scales, several long dark bristles; postpronotum covered with narrow curved scales, reddish-black ones dorsally and white ones medially, 5-6 posterior dark bristles; propleuron with a patch of broad white scales, several golden bristles; postspiracular area with a patch of broad white scales, 4-5 golden bristles; subspiracular area with 2 patches of broad white scales, lower one larger; mesepisternum with median, upper and posterior patches of broad white scales, median patch small, several upper and posterior golden bristles, lower ones shorter; prealar knob with several golden bristles (2 specimens from Ceylon had 2-3 broad white scales on ventral margin); paratergite with broad white scales on latero-ventral margin; mesepimeron with a large patch of broad white scales and several golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several brown or golden bristles, I with broad brown scales and a few white ones intermixed on anterior and lateral surfaces, a small patch of broad white ones dorsally, II with anterior surface covered with broad brown scales and a small patch of broad white ones dorsally, III with a few broad white scales posteriorly; trochanters I-III each with a patch of ventral broad dusty-white scales, a few white apical ones on III; femora I-III brown, each with anterior and posterior surface with intermixed white scales and a dorsoapical white spot, posterior surface of II, III with numerous white scales nearly covering basal 0.50 of II and basal 0.75 of III; tibiae I-III brown, each with intermixed white scales and a small dorsoapical white spot, I with an indistinct posteroventral longitudinal white stripe, II with an indistinct posteromedian longitudinal white stripe; tarsi I-III brown, I with tarsomeres 1-2 each with a basal white band, tarsomere 3 with a dorsobasal white spot, II with tarsomeres 1-3 each with a basal white band, tarsomeres 4 with a dorsobasal white spot, III with tarsomeres 1-4 each with a basal white band, tarsomere 5 with a dorsobasal white spot, a few scattered white scales on tarsomere 1; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple. *Wing*. Dorsal veins covered with moderately broad brown scales with white ones intermixed, approximately 30 percent of the scales white; tertiary fringe scales with white and brown scales intermixed along posterior margin of wing; costa with a small white spot at base; ventral veins brown scaled with white scales intermixed; alula with narrow brown scales along fringe; 1-2 remigial bristles. *Halter*. Pedicel pale, capitellum white scaled. *Abdomen*. Terga brown with broad dorsobasal white bands on II-VI and a few basal pale scales on VII; tergum I with several white scales mesally and a rectangular patch of white scales on laterotergite; terga II-VII each with a lateromedian patch of white scales, patches not connected to dorsal bands; sterna with lateral areas mainly pale scaled, median and posterior areas brown; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 27). Tergum VIII index 0.73-0.79; sternum VIII index 1.05-1.11; tergum IX bilobed with 4-7 bristles on each lobe, index 1.22-1.41; insula tongue-like, covered with minute setae and with 4-5 small tuberculi

on apical 0.25; lower vaginal lip, narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderate to heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 5-8 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.96-1.09, ventral PGL index 2.08-2.36; cercus long, 0.90-1.00 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 3.33-3.41, cercus/dorsal PGL index 3.46-4.50; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 10). Similar to female in general habitus. *Head.* Maxillary palpus brown with dorsobasal white spots on apical 2 segments, a few scattered white scales on antepenultimate segment, longer than proboscis by length of apical segment; proboscis brown with a few scattered ventral white scales. *Legs* (Fig. 17). Tarsus I with tarsomere 1 also with a few scattered white scales, tarsomere 4 with a basal white band; tarsus III with tarsomere 5 with a narrow basal white band; posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III unequal, simple. *Wing.* Basal white spot on costa reduced. *Abdomen.* Terga brown with broad basal white bands on II-VII and a few lateromedian white scales on V-VII; tergum VIII white with a few lateral brown scales. *Genitalia* (Fig. 43). Tergum IX strongly bilobed with 5-7 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with a few scattered short fine bristles, mostly along tergomesal margin, lateral surface with numerous long stout bristles from base to apex, ventral surface with a number of moderately long to long stout bristles on distal 0.35 and scattered short ones over the remainder, scattered scales on lateral and ventral surface; gonostylus with pedicel very short and broad, distal 0.63 expanded into a large mesal lobe and a lateral longer, narrow, slightly incurved, tapered horn attached approximately 0.43 from base with a very short fine apical hair, mesal expanded lobe with a long, flattened, pigmented gonostylar claw attached mesally near middle, a short fine hair near base of claw and short hair-like spicules extending from claw proximad, 2-3 short fine hairs near apex and 3-4 similar ones scattered over tergal surface of lobe; basal mesal lobe short and rounded apically, distal 0.25 with 4-5 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a small subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 4-7 short blunt lateral teeth on distal 0.60 and covered with a dorsal flap, paramere long, approximately 0.98 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 2-3 bristles near center.

PUPA (Fig. 56). Chaetotaxy as recorded in Table 8. *Cephalothorax.* Hair 5-C with 3-5 branches; 7-C with 3-6 branches; 8-C with 2-7 branches. *Respiratory trumpet.* Moderately pigmented; index 3.06-4.38, average 3.72. *Metanotum.* Hair 10-C with 5-9 branches; 12-C with 4-7 branches. *Abdomen.* Hair 5-I with 7-16 branches; 1-II with 13-20 branches; 4-II with 7-16 branches; 14-II single; 1-III with 5-10 branches; 6-VI double or triple; 1-VII with 3-6 branches; 6-VII with 6-14 branches; 9-VII with 3-6 branches, 11-VII single or double. *Paddle.* Ovoid; with very minute serrations along basal 0.50 of outer margin; midrib does not reach apex; hair 1-P short, single; index 1.18-1.53, average 1.41.

LARVA (Fig. 67). Chaetotaxy as figured. *Head.* Hairs 1, 3, 14-C single; 4, 6-C with 4-6(5) branches; 5, 11-C with 5-7(5) branches; 7-C with

6-10(6) branches; 8, 13-C with 2-4(3) branches; 9-C with 3-4(3) branches; 10-C double or triple (2); 12-C with 4-6(4) branches; 15-C single to triple (1); basal maxillary hair single; mental plate with 26-36(28) teeth. *Antenna.* Lightly pigmented; numerous spicules scattered over entire shaft; hair 1-A with 5-9(6) branches, inserted 0.38-0.45 from base; 2-A long; 3-A approximately 0.50 length of 2-A. *Thorax.* Hair 0-P with 5-7(6) branches; 1, 5, 6, 10-P single; 2, 9-P double or triple (2); 3, 4, 7-P double or triple (3); 8-P single or double (2); 11-P double; 12, 14-P single or double (1); 1-M with 3-5(4) branches; 2-M single or double (1); 3-M with 2-4(3) branches; 4-M with 3-6(4) branches; 5, 7, 10, 11, 12-M single; 6-M with 4-6(5) branches; 8-M with 6-8(7) branches; 9-M with 6-10(6) branches; 13-M with 5-10(6) branches; 14-M with 5-8(6) branches; 1, 11, 12-T single or double (1); 2, 4-T with 3-7(4) branches; 3-T with 10-23 (16) branches; 5, 10-T single; 6-T double or triple (2); 7-T with 6-10(6) branches; 8-T with 4-7(6) branches; 9-T with 4-7(6) branches; 13-T with 5-12(5) branches. *Abdomen.* Hairs 0, 14-VIII single; 1-VIII with 4-7(5) branches; 2-VIII single to triple (2); 3-VIII with 6-12(10) branches; 4-VIII double or triple (2); 5-VIII with 4-8(5) branches; 6-IV-VI short; comb with 18-30(18) scales arranged in 3 irregular rows, scales with short stout denticles along lateral and apical margins; 1-X single or double (1); 2-X with 8-14(9) branches; 3-X single; ventral brush varies from 9 hairs on grid and 3 precratal ones to 11 hairs on grid and 1 precratal hair, usually with 10 hairs on grid and 2 precratal ones; saddle lightly pigmented with minute ridges, incompletely rings segment, with a few spicules along posterior margin, acus small; 4 anal papillae, long, each with a broad base and tapering to a pointed apex. *Siphon.* Moderately pigmented with minute ridges; acus present; index 5.00-5.56; pecten with 15-19(17) teeth, apical 2-3 teeth longer and wider spaced than remainder which have a slender apical attenuated filament with 1-3 basal denticles; hair 1-S with 3-4(3) branches, inserted 0.61-0.68 from base.

TYPE DATA. *Stegomyia pipersalata* Giles, holotype female, Jhansi, Gonda, *N. W. Provinces,* INDIA, August 1900, Lt. Col. G. M. Giles, in British Museum (Natural History); *Pseudograbhamia maculata* Theobald, syntypes female and male, Galgamuwa, CEYLON, August 1902, Green, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--13 males, 32 females, 2 pupae, 14 larvae and 2 individual larval rearings from the following locations:

CAMBODIA. Kirirom.

CEYLON. Galgamuwa, Polgahawela; Hunuwilagama, Wilpattu.

INDIA. Belgaum, *Bombay Deccan,* Tavargatti; *Northwest* Gonda.

THAILAND. *Kanchanaburi* Ban Sai Yok.

WEST PAKISTAN. Lahore.

Other distribution.

CEYLON (Chow et al. 1954: 117); Colombo (James 1914: 262); Andankulam near Trincomalee (Carter and Wijesundara 1948: 141); *North-Western Province,* Bandarakoswatte, Magulagama (Carter 1948: 313).

INDIA. *Mardas,* North Arcot (Reuben 1971: 120); *North West Provinces,* Gonda, Jhansi (Giles 1902: 372); Madras Town (Theobald 1910b: 292); Pusa (Senior-White 1923: 81); *Bengal; Central Provinces;* Anwarganj, Cownpore District; Cuttack, Kamptee, Nagpur District, Madhupur, Pusa, Ranihat (Barraud 1928: 664); *Poona,* Baramati (Rao and Rajagopalan 1957: 10); *Bombay,* Kamptee, Belgaum, Tawargatti; *Bihar,* Ranihat; *Orissa,* Cuttack; *Uttar Pradesh,* Anwarganj, Kanpur, Dehra Dun, Kalsi (Wattal et al. 1958: 223).

WEST PAKISTAN. Baradark Garden, Bolarum (Qutubuddin 1951: 30); *Kohat,* Kohat-Hangu Valley (Qutubuddin 1960: 358).

TAXONOMIC DISCUSSION. *Aedes pipersalatus* is similar to *taeniorhynchoides*, *vexans vexans* and *vexans nipponii* in the adult habitus. *Pipersalatus* possesses the following features: scutum with definite white scale patches; postprocoxal membrane bare; scutellum with a patch of broad and a few narrow curved white scales on midlobe; and wing with approximately 30 percent of the scales white and intermixed with brown ones while *taeniorhynchoides* has the following: scutum lighter scaled with indistinct dorsal patches of white scales; postprocoxal membrane with a few small broad white scales; scutellum with only narrow curved white scales on midlobe; and wing with approximately 40 percent of the scales white and intermixed with brown ones. From *vexans vexans* and *vexans nipponii* these 2 species are easily separated by the large number of white scales intermixed with brown ones on most of the dorsal veins of the wing especially on the radius and among the tertiary fringe scales along the posterior margin of the wing. The scales on the distal 0.85 of the radius 2+3 and along the posterior margin of the wing are all brown in *vexans vexans* and *vexans nipponii*. Other features of *pipersalatus* are: scutal fossal area of scutum with 4-5 bristles; postpronotum with 5-6 posterior bristles; and postspiracular area with 4-5 bristles while *vexans vexans* and *vexans nipponii* possess the following: scutal fossal area of scutum with 9-11 bristles; postpronotum with 8-10 bristles; and postspiracular area with 8-9 bristles.

The postgenital lobe of the female genitalia has a deep median apical indentation in *pipersalatus* but only a moderately deep one in *taeniorhynchoides*.

The male genitalia of *pipersalatus* are very similar to *taeniorhynchoides* but differ in the shape of the gonostylus, number of bristles on basal mesal lobe (4-5 in *pipersalatus* and 6-11 in *taeniorhynchoides*) and number of bristles on sternum IX(2-3 in *pipersalatus* and 4-5 in *taeniorhynchoides*).

The pupa of *pipersalatus* resembles *culicinus* and can be separated from this species by abdominal hair 4-II which has 7-16 branches as compared to 2-5 branches in *culicinus*.

The chaetotaxy of the larva is similar to *alboscutellatus* and is discussed under that species.

BIOLOGY. In Thailand immatures were collected from a small unshaded flood pool with turbid fresh water, with scarce emergent aquatic vegetation, located in a teak plantation in the plains, and at an altitude of 400 feet. Larvae were collected in association with the following species of mosquitoes: *Aedes culicinus, imprimens, pallidostriatus* and *Anopheles kochi.*

Larvae were collected in jungle pools in India. Pupae were found in paddy fields and in a coconut treehole in Ceylon and adults were collected in a Malaise trap at an elevation of 200 feet.

In India, immatures were collected from ground pools and water-filled ditches (Barraud 1934: 260) and adults were taken in indoor shelters and biting outdoors (Rao and Rajagopalan 1957: 10). Qutubuddin (1960: 358) collected larvae from a rotten masonary well in West Pakistan. Carter (1948: 314), working in Ceylon, collected adults from a cattle baited trap.

AEDES (AEDIMORPHUS) PUNCTIFEMORIS (LUDLOW)
(Figs. 11, 16, 17, 28, 44)

Stegomyia punctifemoris Ludlow 1921, Mil. Surg. 49: 690 (♀).

Aedes (Stegomyia) punctifemore Ludlow, Edwards 1922b, Indian J. med. Res. 10: 465.

Aëdes (Finlaya ?) punctifemore Ludlow, Dyar and Shannon 1925, Insecutor Inscit. menstr. 13: 75 (♀).

Aëdes (Aëdimorphus) punctifemore Ludlow, Dyar 1925, Insecutor Inscit. menstr. 13: 217 (♂); Edwards 1932, Genera Insec., Fasc. 194: 168.
Aëdes (Aëdimorphus) punctifemore (Ludlow), Edwards *in* Barraud 1934, Fauna Brit. India, Diptera 5: 443 (♀).
Aedes (Aedimorphus) punctifemore (Ludlow), Bohart 1945, Navmed 580, p. 64 (♂, ♀*); Knight and Hull 1953, Pacif. Sci. 7: 459 (♂* ♀).
Aedes (Aedimorphus) punctifemoris (Ludlow), Stone et al. 1959, Thomas Say Found. 6: 196; Aslamkhan 1971, Biologia 17: 61 (♂*, ♀).

FEMALE (Fig. 11). *Head.* Antenna dark brown, approximately equal in length to proboscis, pedicel pale with a patch of broad silvery scales and a few short fine brown hairs mesally, flagellomere 1 pale with a few small brown scales; clypeus dark brown, bare; maxillary palpus brown scaled with tuft of pale hairs at tip, approximately 0.18 length of proboscis; proboscis golden-brown scaled with apical 0.25 and basal 0.10 dark brown, approximately 1.33 length of femur I; vertex and sides covered with broad decumbent scales, dorsum with an anteromedian diamond-shaped light brown group and remainder silvery-white; lateral surface with an anterodorsal triangular light brown patch separated from lower brown area by a white stripe extending from eye margin posteromesally to occiput; narrow white scales and numerous dark brown erect forked scales on occiput, fewer scales on vertex which extend to ocular line. *Thorax.* Scutal integument dark brownish-black; scutum covered with narrow curved reddish-black scales, broad silvery scales forming patches on anterior promontory area, scutal fossal areas (anterior, lateral and posterior areas each with a circular patch), supra-alar area with a small patch anterior to and one posterior to wing base, posterior medial scutal area, prescutellar space along posterolateral margins and a few scattered broad white scales among posterior dorsocentral bristles; scutellum with a patch of broad silvery scales on each lobe (one Philippine specimen with broad pale brown scales on median lobe); median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 3-4 lateral and 1-2 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed, others absent; pleural integument dark reddish-brown; antepronotum with a few broad silvery scales, several dark bristles; postpronotum with narrow curved reddish-black scales dorsally and a posterior patch of broad silvery scales, 4-5 posterior dark bristles; propleuron with a patch of broad silvery scales, several dark bristles; postspiracular area with 4-5 dark bristles; subspiracular area with 2 small patches of broad silvery scales; mesepisternum with a small upper and a small posterior patch of broad silvery scales, several upper and posterior dark bristles, lower ones shorter; prealar knob with several dark bristles; paratergite covered with broad silvery scales; mesepimeron with a small patch of broad silvery scales and 5-6 dark bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several dark bristles, I with broad brown scales on anterior and lateral surfaces and a dorsal patch of silvery scales, II with an anteromedian silvery patch of scales with a few brown ones below, III with a few anteroventral pale brown scales; trochanters I-III each with brown scales; femora I-III brown, each with a dorsoapical silvery spot and several broad silvery scales scattered over anterior surface; femur I with posterior brown with several broad silvery scales intermixed; femora II, III each with basal 0.75 mainly brownish-white scaled, remainder brown; tibiae I-III brown, each with a dorsoapical silvery spot and several broad silvery scales scattered over surfaces, mainly on anterior sur-

face; tarsi I-III brown; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple. *Wing.* Dorsal veins covered with moderately broad brown scales with a silvery patch at base of costa; alula with narrow brown scales along fringe; 2-3 remigial bristles. *Halter.* Pedicel pale brown, capitellum brown scaled. *Abdomen.* Terga brown; tergum I with a rectangular patch of silvery-white scales on laterotergite; terga II-VII each with a small laterobasal patch of silvery scales; sterna brown scaled; terga and sterna with numerous golden-brown bristles, mostly along posterior margins. *Genitalia* (Fig. 28). Tergum VIII index 0.78-0.85; sternum VIII index 0.82-0.86; tergum IX bilobed with 3-6 bristles on each lobe, index 1.05-1.27; insula tongue-like, covered with minute setae and with 5-7 small tuberculi on apical 0.25; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, heavily pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 6-10 bristles on each side of midline, covered with minute setae, dorsal PGL index 1.26-1.38, ventral PGL index 2.06-2.34; cercus moderately long, 0.80-0.90 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 2.76-3.06, cercus/dorsal PGL index 2.55-2.97; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 11). Similar to female in general habitus. *Head.* Maxillary palpus brown, longer than proboscis by length of apical segment. *Thorax.* Propleuron with only 1-3 dusky-white scales, numerous dark bristles. *Legs* (Fig. 17). Posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III unequal, simple. *Abdomen.* Tergum I brown with a patch of silvery scales on laterotergite; terga II-VII brown each with a small laterobasal patch of silvery scales; tergum VIII silvery; sterna brown with an incomplete white stripe on lateral margins of sterna III-VIII. *Genitalia* (Fig. 44). Tergum IX strongly bilobed with 6-7 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with a few long stout bristles along lateral margin and scattered moderately long and short ones over remainder of area, very short fine bristles along tergomesal margin, lateral surface with long stout and a few moderately long bristles, ventral surface with long stout bristles on distal 0.45 and moderately long ones along sternomesal margin, very numerous on distal 0.75, scattered short bristles over remainder of area, scattered scales on lateral and ventral surfaces; gonostylus with pedicel moderately long, narrow and somewhat incurved, distal 0.46 expanded into a mesal lobe and a lateral short tapering apically pointed horn attached approximately 0.72 from base with a short fine hair at apex, mesal expanded lobe with a moderately long, flattened, curved, apically blunt gonostylar claw attached mesally near middle, 2 short stout bristles at apex and 2-4 slightly smaller ones along apical margin, 3-4 short fine hairs on tergal surface proximad of claw; basal mesal lobe short and rounded apically, distal 0.45 with 4-6 short bristles, entire surface covered with short hair-like spicules; proctiger short, paraproct with a subapical thumb-like process, cercal setae absent; phallosome with aedeagus of type I with 2 lateral plates connected basally, each plate with 5-6 short blunt lateral teeth on distal 0.56 and covered with a dorsal flap, paramere long, approximately 0.80 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 4-5 bristles near center.

PUPA and LARVA. Not known.

TYPE DATA. *Stegomyia punctifemore* Ludlow, holotype female, Fort

Wm. McKinley, Rizal, *Luzon*, PHILIPPINES, 20 August 1921, in United States National Museum (Natural History).

DISTRIBUTION. Specimens examined--2 males and 22 females from the following locations:

BANGLADESH (East Pakistan). *Dinajpur*, Thakurgaon.

INDIA. *Bihar*, Gaya.

PHILIPPINES. *Luzon*, Wack-Wack; *Rizal*, Camp Nichols, Ft. Wm. McKinley.

Other distribution.

BANGLADESH (East Pakistan). *Dinajpur*, Thakurgaon, Akcha, Madargonj (Aslamkhan and Wolfe 1971: 31).

PHILIPPINES. *Samar*, Osmena (Knight and Hull 1953: 460).

TAXONOMIC DISCUSSION. *Aedes punctifemoris* is a very distinct species and is easily recognized by the following features: vertex covered with broad scales; scutum with patches of broad white scales; antepronotum and postpronotum each with a few broad silvery-white scales; postspiracular area without scales; femora and tibiae with broad silvery-white scales intermixed with the brown ones; and tarsi dark scaled.

BIOLOGY. Adults were taken in light traps in the Philippines.

Aslamkhan (1971: 64) collected this species in abundance after monsoon rains during June and July in Bangladesh (East Pakistan). He collected only 11 females resting in houses while 129 were taken biting man after dusk. One hundred twenty-seven specimens were dissected and found to be negative for *Wuchereria bancrofti*.

AEDES (AEDIMORPHUS) VEXANS VEXANS (MEIGEN)
(Figs. 14, 16, 17, 31, 33, 47, 57, 68)

Culex vexans Meigen 1830, Syst. Beschr. zweifl. Ins. 6: 241 (♀); Theobald 1903, Monogr. Cul. 3: 404 (♂*, ♀*); Giles 1902, Handb., p. 416 (♂*, ♀*); Blanchard 1905, Moust., p. 309 (♂*, ♀*); Theobald 1905, Genera Insec., Fasc. 26: 26.

Culex nocturnus Theobald 1903, Monogr. Cul. 3: 159 (♀*); Theobald 1905, Genera Insec., Fasc. 26: 25; Theobald 1910, Monogr. Cul. 5: 324. NEW SYNONYM.

Culicada minuta Theobald 1907, Monogr. Cul. 4: 338 (♀*); Theobald 1910, Monogr. Cul. 5: 294; Brunetti 1912, Rec. Indian Mus. 4: 462.

Culicada eruthrosops Theobald 1910, Monogr. Cul. 5: 299 (♀*); Brunetti 1912, Rec. Indian Mus. 4: 462.

Culex nocturnus var. *niger* Theobald 1913a *in* Sarasin and Roux, Nova Caledonia A., Zool. 1: 164 (A).

Ochlerotatus vexans Mg., Edwards 1917, Bull. ent. Res. 7: 218; Brunetti 1920, Rec. Indian Mus. 17: 135; Senior-White 1923, Cat. Indian Insects, Cul., p. 83.

Aëdes (Ecculex) vexans (Mg.), Edwards 1921, Bull. ent. Res. 12: 322.

Aedes (Ecculex) vexans Mg., Edwards 1922b, Indian J. med. Res. 10: 467.

Aëdes (Aëdimorphus) vexans Meigen, Edwards 1924, Bull. ent. Res. 14: 372; Brug 1924, Bull. ent. Res. 14: 436 (L); Dyar and Shannon 1925, Insecutor Inscit. menstr. 13: 77; Buxton and Hopkins 1925, Bull. ent. Res. 15: 300 (L); Borel 1930, Coll. Soc. Path. exot. Monogr. 3: 275 (♂*, ♀); Lee 1944, Atlas Mosq. Larvae Australian Region p. 72 (L*); Natvig 1948, Suppl. Norsk ent. Tidsskr. 1: 412 (♂*, ♀, L*).

Aedes (Aedimorphus) vexans (Meigen), Barraud 1928, Indian J. med. Res. 15: 660 (♂*, ♀*); Penn 1949, Pacif. Sci. 3: 60 (P*); Horsfall and Craig 1956, Ann. ent. Soc. Am. 49: 370 (E*); Stone et al. 1959, Thomas Say Found. 6: 198; Assem and Bonne-Wepster 1964, Zool. Bijdr. 6: 99 (♂, ♀, L*); Mohrig 1967, Angew. Parasit. 8: 80 (♀*); Kalpage and Brust 1968, Can. J. Zool. 46: 711 (E*); Pao and Knight 1970, J. Geo. ent. Soc. 5: 115 (L*).

Aëdes (Aëdimorphus) vexans (Meigen), Barraud 1934, Fauna Brit. India, Diptera 5: 253 (♂*, ♀, L).

Aedes (Aedimorphus) vexans Meigen, Bohart 1945, U. S. Navmed. 580, p. 64 (♂*, L); Bonne-Wepster 1954, Doc. med. Geogr. Trop. 6: 239 (♂, ♀, L*).

Aedes (Aedimorphus) vexans nocturnus (Theobald), Bohart and Ingram 1946, U. S. Navmed. 1055, p. 15 (♂, ♀, P*, L); Yamaguti and La Casse 1950, Mosquito Fauna Guam, p. 73 (♂*, ♀*, L*); Knight and Hull 1953, Pacif. Sci. 7: 460 (♂*, ♀, L*); Bohart 1956 (1957), Insects Micronesia 12: 59 (♂*, ♀, L*); Stone et al. 1959, Thomas Say Found. 6: 198; Lein 1962, Pacif. Insects 4: 627.

Aedes (Aedimorphus) nocturnus (Theobald), Belkin 1962, Mosquitoes S. Pacif., p. 427 (♂*, ♀, P*, L*); Stone 1963, Proc. ent. Soc. Wash. 65: 130; Belkin 1965, Contr. Am. ent. Inst. 1(4): 23.

FEMALE (Fig. 14). *Head.* Antenna dark brown, approximately 1.02 length of proboscis, pedicel pale brown with several small white scales and a patch of short fine dark hairs mesally, flagellomere 1 pale with a few small pale scales; clypeus light brown, bare; maxillary palpus brown scaled with white scales at apex, base of segment 4 and occasionally along outer lateral margin of segments 3-4, approximately 0.18 length of proboscis; proboscis brown scaled dorsally with scattered white scales on basal 0.75, ventral and lateral surfaces golden-white scaled from near base to apical 0.25 which is entirely dark, approximately 1.22 length of femur I; vertex with dorsum covered with narrow curved decumbent scales, an anteromedian diamond-shaped brown group and the remainder white; lateral surface covered with broad scales, an anterodorsal black patch with white ones below and a second lower black patch in some specimens, occasionally a large patch of dusky scales anterior to antepronotum, small narrow decumbent white scales on occiput and posterior to the anterodorsal black patch; numerous golden and brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument dark brownish-black; scutum covered with narrow curved reddish-black scales, scutal patterns vary considerably but usually with narrow curved white scale patches on median anterior promontory area, scutal fossal areas extending from anterior area along margin and onto lateral area, small patch at scutal angle, supra-alar area above posterior of paratergite extending to posterior of wing base, posterior medial scutal area, along lateral margins of prescutellar space and among posterior dorsocentral setae, an indistinct patch of narrow dusky-white scales lateral to posterior dorsocentral setae above supra-alar white patch; scutellum with a patch of narrow curved white scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 4-7 lateral, 1-2 median and 2-3 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-black and well developed; pleural integument dark to light brown; antepronotum covered with narrow curved white scales with a few broad white ones anteriorly, several dark bris-

tles; postpronotum dark, completely covered with narrow curved scales, a small patch of lower posterior white ones and the remainder reddish-black, some specimens also with a few lower broad white scales, 7-10 dark posterior bristles; propleuron with a patch of broad white scales, several golden bristles; prosternum with narrow white scales and 1-3 bristles; postspiracular area with a large patch of narrow curved or moderately broad scales or both, 7-9 golden bristles; subspiracular area with 2 patches of broad white scales, lower one longer; mesepisternum with an upper and a posterior patch of broad white scales, several upper and posterior golden bristles, lower ones shorter; prealar knob with a small patch of long broad white scales on lateroventral margin, several golden bristles; paratergite with a patch of white scales on lateral margin, scales vary in shape, some specimens with narrow curved ones, some with moderately broad ones and some with both types; mesepimeron with a patch of broad white scales and several golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several golden bristles, I, II each with anterior surface covered with broad white scales, I also with a few to a large patch of broad brown ones near middle, III with an anterodorsal and an anteroventral patch of broad white scales; trochanters I-III each with broad white scales; femora I-III each with anterior surface brown with varying amounts of white scales intermixed and a dorsoapical white spot, III with a broad longitudinal white stripe tapering from base to apical 0.25, I, II each with a narrow basal white band, in some specimens there are only a few scattered white scales on I but there are always numerous ones on II (Oriental Region); femora I-III each with posterior surfaces with a broad longitudinal white stripe tapering from base to apical 0.25 and the remainder brown with intermixed white scales, stripe dorsal on I and ventral on II, III; tibiae I-III each brown with a few scattered white scales, a narrow basal white band and posterior longitudinal white stripe from base to apex, stripe posteroventral on I; tarsi I-III brown, I with tarsomeres 2, 3 each with a basal white band, tarsomere 1 usually with a small dorsobasal white spot and a posterior longitudinal white stripe, tarsomere 4 with a dorsobasal white spot, II with tarsomeres 1-3 each with a basal white band, tarsomere 4 with a dorsobasal white spot, tarsomere 1 with a posterior longitudinal white stripe, III with tarsomeres 1-5 each with a basal white band, tarsomere 1 with a few scattered white scales; posttarsi I-III each with 2 ungues, I, II equal, each with a tooth, III equal, simple, occasionally toothed. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with a small patch of white scales at base and along its posterior margin from just before humeral cross vein to apical 0.66, some specimens also with scattered white scales on radius and median; ventral veins brown scaled; alula with narrow brown scales along fringe; 2-3 remigial bristles. *Halter*. Pedicel pale, capitellum white scaled with a few brown scales mesally. *Abdomen*. Terga brown; tergum I with a few basomedian white scales, laterotergite with a rectangular patch of white scales; terga II-VI each with a dorsobasal broad white band, posterior margins of bands vary from being straight to notched mesally; terga VI, VII each with a narrow apical white band, VII also with a pair of laterobasal triangular white patches on dorsum, patches occasionally forming a notched basal band; tergum VII with a few white scales on apical margin; terga II-VII each with a large laterobasal patch of white scales, patches not connected with dorsal bands; sterna creamy-white scaled with a few brown scales mesally on III-VII; terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 31). Tergum VIII index 0.79-0.88; sternum VIII index 0.94-0.99; tergum IX bilobed with 5-14 bristles on each lobe, index 0.90-1.12;

insula tongue-like, covered with minute setae; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderately pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 5-10 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.70-0.91, ventral PGL index 1.52-1.86; cercus moderately long to long, 0.90-1.00 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 3.21-4.27, cercus/dorsal PGL index 4.35-5.22; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 14). Similar to female in general habitus. *Head.* Maxillary palpus brown, segments 2-5 each with a dorsobasal white spot, longer than proboscis by 0.75 of apical segment; vertex with anteromedian brown and anterodorsal black scale patches reduced. *Thorax.* Prosternum bare. *Legs* (Fig. 17). Tibia II with posterior white stripe broad; posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple, occasionally toothed. *Abdomen.* Terga brown without lateral spots; tergum II with basal white band, posterior margin of band straight; terga III-VII each with a basal white band broad on lateral margins and deeply notched mesally, some specimens also with a few median apical white scales; tergum VIII white, some specimens with a few brown scales mesally; sterna white with an indistinct median longitudinal brown stripe, stripe distinct on VIII. *Genitalia* (Figs. 33, 47). Tergum IX strongly bilobed with 6-11 bristles on each lobe, entire surface covered with minute spicules; gonocoxite long and moderately broad, dorsal surface with long stout bristles along lateral margin from base to apex, short thin bristles along tergomesal margin from base to apex and similar ones extending along base to lateral margin, lateral surface with long stout bristles from base to apex, ventral surface with long stout bristles on distal 0.60 of sternomesal margin, a few similar ones on apical 0.25 of area, short to moderately long bristles on proximal sternomesal margin and scattered over remainder of surface, scattered scales on lateral and ventral surfaces; gonostylus approximately 0.69 length of gonocoxite, moderately broad throughout length with distal 0.20 tapering to a blunt point with 2-3 short fine hairs near apex, laterotergal surface somewhat curved dorsally and covered with short hair-like spicules on apical 0.50, gonostylar claw long, narrow, pigmented, with apex blunt, 10-16 short fine hairs scattered over distal 0.60 of flattened area; basal mesal lobe short with apical 0.25 rounded, somewhat expanded and bearing 25-38 short bristles, entire surface covered with short hair-like spicules; proctiger long, paraproct narrow with apex bluntly pointed and entire structure strongly pigmented, cercal setae absent; phallosome with aedeagus of type II with 2 lateral plates connected basally, each plate with 5-6 short to moderately long, longitudinal lateral teeth with tergally curved apices and covered with a dorsal flap, paramere long, approximately 0.94 length of lateral plate; sternum IX large, entire surface covered with minute spicules, 4-5 bristles near center.

PUPA (Fig. 57). Chaetotaxy as figured and recorded in Table 9. Two to three rows of spicules mesally along posteroventral margin of abdomen II. *Cephalothorax.* Hair 5-C single to triple; 7-C with 2-5 branches; 8-C with 2-4 branches. *Respiratory trumpet.* Moderately pigmented; index 2.70-3.24, average 2.96. *Metanotum.* Hair 10-C with 4-11 branches; 12-C single to triple. *Abdomen.* Hair 5-I with 2-8 branches; 10-I single; 1-II with 5-14 branches; 4-II with 2-4 branches; 1-III with 3-5 branches; 6-VI single or double; 1-VII single to triple; 6-VII with 2-5 branches; 9-VII with 2-4 branches; 11-VII single. *Paddle.* Ovoid; with very minute serrations along basal 0.55 of outer margin;

tiny spicules along apical 0.45 of outer and apical 0.25 of inner margins; midrib does not reach apex; hair 1-P short, single; index 1.17-1.49, average 1.28.

LARVA (Fig. 68). Chaetotaxy as figured. *Head.* Specimens from Southeast Asia have the frontoclypeus granulose; median mouth brushes pectinate apically; hairs 1, 3, 8, 14-C single; 4, 15-C with 3-5(4) branches; 5, 9, 10, 13-C single to triple (2); 6-C single or double (1); 7-C with 7-11(9) branches; 11-C with 3-8(6) branches; 12-C with 3-9(5) branches; basal maxillary hair single; mental plate with 27-32(29) teeth. *Antenna.* Short and moderately pigmented; with small stout spicules scattered over shaft, more numerous on basal 0.50; hair 1-A with 5-10(8) branches, inserted 0.36-0.44 from base; 2-A long; 3-A approximately 0.50 length of 2-A. *Thorax.* Hair 0-P with 4-9(6) branches; 1, 2, 5, 6, 10, 12-P single; 3-P single to triple (2); 4, 9, 14-P single to double (1), 7-P double or triple (3); 8-P with 3-7(4) branches; 11-P with 2-4(3) branches; 1, 2, 4-M with 2-4(3) branches; 3, 5, 7, 10, 11, 12-M single; 6-M with 5-8(5) branches; 8-M with 6-9(6) branches; 9-M with 5-8(6) branches; 13-M with 4-9(4) branches; 14-M with 4-9(6) branches; 1, 4-T with 2-4(3) branches; 2-T with 2-4(2) branches; 3-T with 3-7(5) branches; 5, 10, 12-T single; 6, 11-T single or double (1); 7-T with 7-10(9) branches; 8-T with 4-7(5) branches; 9-T with 4-6(4) branches; 13-T with 5-9(6) branches. *Abdomen.* Hairs 1, 2-VIII on common basal plate; hairs 0, 14-VIII single; 1-VIII with 5-12(8) branches; 2, 4-VIII double or triple (2); 3-VIII with 6-10(9) branches; 5-VIII with 7-10(9) branches; 6-III-VI long; comb of 7-12(8) scales arranged in 1-2 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1, 3-X single; 2-X with 5-8(7) branches; ventral brush varies from 12 hairs on grid and 4 precratal ones to 14 hairs on grid and 3 precratal ones, usually with 13 hairs on grid and 3 precratal ones; saddle moderately pigmented, incompletely rings segment, with small spicules along posterior margin, acus present; 4 anal papillae, long and tapering to a blunt point. *Siphon.* Moderately pigmented with minute ridges over entire surface; acus large; index 2.11-3.10; pecten with 13-18(16) teeth, apical 2-3 teeth larger, smooth or with a minute basal denticle and wider spaced than remainder which have a slender apical attenuated filament with 1-3 basal denticles; hair 1-S with 5-6(5) branches, inserted 0.54-0.69 from base.

EGG. *Shape.* Variable, fusiform to spindle-shaped; greatest diameter between anterior third and middle. *Size.* In microns, 648-756 by 171-216 (Horsfall and Craig), 614-713 by 199-224 (Myers) and 630-745 by 167-205 (Kalpage and Brust). *Color.* Bronze. *Chorion.* Surface reticulation consisting of a pattern of axially linear cells, hexagonal and polygonal in shape and 2.5-5 times as long as wide; cell walls raised. The above description is taken from Horsfall and Craig (1956: 370), Myers (1967: 796) and Kalpage and Brust (1968: 711-712).

TYPE DATA. *Culex vexans* Meigen, holotype female, near Berlin, GERMANY, Ruthe, in Museum National d'Histoire Naturelle, Paris, France; *Culex arabiensis* Patton, syntypes male and female, Ulub Camp and Carter, *West Aden Protectorate,* types nonexistent; *Culex articulatus* Rondani, ITALY, location of type unknown; *Aedes euochrus* Howard, Dyar and Knab, Popcum, *British Columbia,* CANADA, 2 August 1903, J. Fletcher, type no. 12057, in United States National Museum (Natural History); *Culicada eruthrosops* Theobald, holotype female, Trincomalee, CEYLON, November 1906, E. Green, in British Museum (Natural History); *Culex malariae* Grassi, ITALY, location of type unknown; *Culicada minuta* Theobald, holotype female, INDIA, Dr. Christophers, in British Museum (Natural History); *Culex nocturnus* var. *niger* Theobald, holotype female (?), Canala, NEW CALEDONIA, in Naturhistorisches

Museum, Basel, Switzerland; *Culex nocturnus* Theobald, 2 syntype females, Ba, FIJI ISLANDS, April-June, Hall, in British Museum (Natural History); *Culex parvus* Macquart, Bordeaux, *Gironde*, FRANCE, type nonexistent; *Culex sylvestris* Theobald, syntype female, Rondeau Provincial Park, Kent Co., *Ontario*, CANADA, 16 September 1899, E. M. Walker, from the interior of a sandy wood of white pine with a few hard woods, and syntype male, De Grassi Pt., Lake Simcoe, *Ontario*, CANADA, 19 July 1899, E. M. Walker, from grass and low herbs in a wood of maple, aspen, balsam and fir, both in British Museum (Natural History).

DISTRIBUTION. Specimens examined--1, 331 males, 4, 149 females, 543 pupae, 1, 003 larvae and 534 individual rearings (52 pupal, 482 larval) from the following locations:

AUSTRALIA. *N. E. New Guinea*, Morobe, Lae; *Papua*, Goodenough Is., Vivigani.

AUSTRIA. Marchegg.

BURMA. Rangoon.

CAMBODIA. Ari Gsatr, Phom-Penh.

CANADA. *Alberta; British Columbia*, Prince George; *Manitoba*, Aweme, Winnipeg; *Ontario*, De Grassi Pt., Lake Simcoe, Rondeau Provincial Park, Kent Co.; *Saskatchewan*.

CAROLINE ISLANDS. Ifaluk Is., Yap Is., Calonia.

CEYLON. Hambantota, Kaude-ela Reservoir, Nuwara-Eliya, Trincomalee, Weligama.

CHINA. *Yunnan; Tibet*, Yatung.

FIJI. Cuvu, Lani, Lawaga, Nacaugai, Nausori, Penang, Soso, Suva.

FRANCE. *Lyon*, Lyon.

GERMANY.

HONG KONG. *Sai Kung*, Ho Chung.

INDIA. *Assam*, Chabua, Doom Dooma, Jorhat, Shillong, Tinsjuia; *Bengal*, Darjeeling, Sukna; *Kashmir*, Srinagar; *Madras*, Coonoor; *Punjab*, Ambala; *Bombay Deccan*, Tavargatti, Nilgiris, Palnis, Kodai Ranal.

INDONESIA. *Celebes*, Bwool, Molino, Paloe, Pare-Pare, Saleier; *Ceram*, Honititoe, Lisiela, Paniwal, Piroe, Vatoenoeoe, Kairatu, Piru, Warasuva; *Flores; Java*, Angki, Batavia, Gombong, Tjilatjap; *Moluccas*, Morotai; *New Guinea*, Hollandia, Mambaye River, Oeta; *Sumatra*, Atjch, Bengkoelen, Ranau; *Timor*, Atamboea; Amboina, Digoel River, Lisabata, Mamoedjoe, Vabaena near Boeton.

IRAN. Enzebi.

IRAQ. *Baghdad*.

ITALY. Lucca.

MACEDONIA. Bajirli, Keulike.

MALAYSIA. *Kedah*, Serdang; *North Borneo*, Membakut; *Pahang*, Bentong, Kg. Sertik; *Perak*, Kuala Kangsar, Lasah; *Selangor*, Puchong, Sabak; *Trengganu*, Marang; Kg. Saban, Semporna, Knantan, Kota Belud, Timbang.

MARIANA ISLANDS. *Guam*, Pt. Oca; *Saipan*, Charan, Hashigaro, Ronoa.

MARSHALL ISLANDS. Ebon Atoll, Eboni.

NEW CALEDONIA. Puebo.

NEW HEBRIDES. Espiritu Santo, Sarakata Valley, Mai Is., Segond Channel.

PHILIPPINES. *Camerines Sur*, Iriga; *Laguna*, Balian; *Leyte*, Abuyog, Burauen, Carigara, Dulag, Gabas, Jinamoc Is., Mahaptag, Tacloban, Tarragona, Tolosa; *Luzon*, Wack-Wack; *Manila; Mindanao*, Bunwan, Dargo,

Kabakan, Ludlow Barracks, Parang, Pettit Barracks, Zamboanga, Torrey Barracks; *Mindoro,* Camiuawit Point, San Jose; *Mountain Province,* Trinidad; *Palawan,* Panakan, Panitian, Quezon, Puerto Princesa, Tarusan; *Pampanga,* Camp Stotsenberg; *Pangasinan* Bayambang, San Fabian, Sison, Tayug; *Rizal,* Alabany, Camp Nichols, Ft. Wm. McKinley, Pasig River; *Samar,* San Antonio; Calaccad, Camp Eldridge, Iloilo, Libjo, Los Banos, Port of Parany, Sanga Sanga Is., Lapit-Lapit, Tawi Tawi Is., Batu Batu, Tayabas, Infanta.

ROMANIA. Bessarabia, Comana Wlasca.

SAMOA. Aeipata, Tutulla, Upolu Is.

SOUTH VIETNAM. *Binh Dinh,* An Tuc, Binh Khe; *Binh Duong,* Lai Khe; *Bien Hoa,* Long Binh; *Cam Ranh,* Cam Ranh Bay; *Da Nang,* Da Nang; *Gia Dinh,* Saigon; *Hau Nghia,* Cu Chi; *Khanh Hoa,* Nha Trang; *Pleiku,* Pleiku; *Quang Tri,* Ba Long; *Thua Thien,* Cu Lai, Phu Bai; *Tuyen Duc,* Da Lat.

SWEDEN. Stockholm.

TAIWAN. Haping, Hwalien, Kelaipao, Shyolin.

THAILAND. *Ayutthaya,* Bang Pa In; *Chiang Mai,* Ban Chang Kien, Ban Hua Muang, Ban Lang Ka, Ban Nong Pa Khrang, Chang Puak, Chiang Mai, Chom Thong, Doi Chom Cheng, Doi Sutep, Hod, Huey Chang Kien, Mea Sanan, Mea Tang, Thanon To Doi Saket; *Chon Buri,* Bang Phra; *Chumphon,* Muang; *Kanchanaburi,* Ban Sai Yok; *Krabi,* Ban Mai Kaen Tai; *Krung Thep,* Bangkok; *Lampang,* Nam Mae Nu Rua; *Nakhon Ratchasima,* Ban Khanong Phra Nua; *Nakhon Sawan,* Ban Kaeng; *Nakhon Si Thammarat,* Ban Rim Thanon; *Narathiwat,* Khau Lau; *Phrae; Rayong; Songkhla,* Haad Yai; *Surat Thani,* Ban Taling Ngam, Ban Thong Phlu, Chom Thong, Ko Samui.

TONGA ISLANDS. Tengatubo.

U. S. A. *Arizona; Arkansas; California; Colorado; Florida; Georgia; Hawaii; Idaho; Illinois; Indiana; Iowa; Kentucky; Louisiana; Maine; Maryland; Massachusetts; Michigan; Minnesota; Mississippi; Missouri; Montana; Nebraska; New Jersey; New Mexico; New York; North Carolina; North Dakota; Ohio; Oklahoma; Oregon; Pennsylvania; South Carolina; South Dakota; Tennessee; Oregon; Pennsylvania; South Carolina; South Dakota; Tennessee; Texas; Utah; Virginia; Washington; Wisconsin; Washington, D.C.*

U. S. S. R. *Siberia,* Amagu, Judia River, Irkutsk, Okeanskya; Saratow.

Other distribution.

ADEN (Edwards 1941: 195); Ulub, Aden, Aden Hintherland (Mattingly and Knight 1956: 119).

ALGERIA. Chebli, Ourgla, (Senevet and Andarelli 1954: 326); La Reghaia (Seneret 1936: 447).

AUSTRALIA. *New Guinea,* Camadodo, Milne Bay; *Papua* (Penn 1949b: 61); *New Guinea,* Finschhafen, Saidor (Bick 1951: 412); *New Guinea,* Wewak-Maprik Road Area (Standfast 1967: 192); *Papua,* Minj (Peters and Christian 1963: 41).

AUSTRIA (Theobald 1901a: 405).

BELEP ISLAND. *Art,* Uala (Laird 1956: 21).

BRITISH HONDURAS (Belkin and Heinemann 1971: 27).

CANADA. *Nova Scotia; Prince Edward Island; Quebec; Yukon* (Carpenter and La Casse 1955: 265); *Ontario,* Aberfoyle, Algonquin Park, Ancaster, Brampton, Camp Borden, Cochrane, Elora, Galt, Kingston, London, Toronto, (Steward and McWade 1960: 157); *New Brunswick,* Younghall; *Ontario,* Ottawa, White River, Dryden, Kenora; *Manitoba,* Winnipeg Beach; *Saskatchewan,* Moose Jaw, Saskatoon, Prince Albert; *Alberta,* Red Deer, Lamoral, Lochearn, Calgary, Banff, Lake Minnewanka; *British Columbia,* Kalso, Ainsworth, Mission, Chilliwack, Whonnock (Dyar 1921: 115).

CAROLINE ISLANDS (Bohart 1956: 59, Belkin 1962: 429).

CHINA. *Hainan Island* (Chu 1958: 109); *Kuangtung,* Swatow (Chung and Lin 1929: 404); *Manchuria,* Hailung (Chin 1936: 23); Hunan (Chang 1939: 61); *Tibet* (Buxton and Hopkins 1927: 91).

CORSICA ISLAND. Debbie, Calvi, Cateraggio, Prunette, Ghisonaccia (Aitken 1954: 480).

CZECHOSLOVAKIA (Kramar 1958: 224); *Moravia,* Vranovice (Palicka 1967: 72); Lower Dnube River Basin (Trpis 1962: 112); *Slovakia* (Vostal 1963: 62).

DENMARK. Bondernes, Egehoved, Naebengen (Nielsen and Nielsen 1963: 147); Sjoelland (Natvig 1948: 418).

ELLICE ISLANDS (Iyengar 1955: 46, 1960: 67); *Nui Island,* Niuafoo (Bohart and Ingram 1946: 16); *Funafuti,* Old airstrip (Laird 1955: 297, 1956: 38); *Nui Island; Niutao Island* (Buxton and Hopkins 1927: 91).

FIJI (Theobald 1903a: 160, Bohart 1956: 59, Lee 1944: 72, Paine 1943: 22, Edwards 1924: 372, Iyengar 1955: 44); Kandavu, Makongai, Taveune, Vanua Levu (Belkin 1962: 429); *Viti Levu,* Nandarivatu (Laird 1956: 39).

FINLAND. Helsingfors, Tvarminne Zoological Station (Natvig 1948: 418).

FRANCE. *Alsace* (Li and Ulu 1933: 105, Callot and Vermeil 1948: 334); Gray; Gave de Pau Valley; Creuse, LaCelle-Dunoise; Lyon (Seguy 1921: 25); Jura Mts. (Callot 1956: 182).

FRIENDLY ISLANDS (Stone et al. 1959: 198).

GERMANY. *Bavaria* (Seguy 1921: 25); *Bavaria,* Dachau, Wartaweil, Ammersee Lake, Puchheim, Graz (Kuhlhorn 1954: 6); Elbe, Rhein and Oden Rivers (Mohring 1965: 4).

GILBERT ISLANDS (Iyengar 1960: 67); *Tarawa Atoll,* Bairiki (Laird 1955: 297).

GREAT BRITAIN. *England, Hants,* Hayling Island; *Herts,* Tring; *Middlesex,* Finchley; *Sussex,* Arundel; *Wales, Meronethshire,* Dolgelly (Marshall 1938: 206); Cambridge, Coe Fen; Shotover near Oxford (Lang 1920: 85); *England,* Wimbledon, (Mattingly 1950: 156; *England, Suffolk,* Mildenhall (Edwards 1912: 195).

GREECE. *Macedonia* (Pandazis 1935: 15).

GUATEMALA. Guatemala City (Belkin and Heinemann 1971: 27.

HUNGARY. Balaton Lake Area (Mihalyi et al. 1952: 336); Matrafured, Gayateto, Parad, Paradfurdo, Pisztrangos-to, Szilvasvarad, Bukk-fennsik, Miskolctapolca, Kacsfurdo, Sikonda-furdo, Budoskut, Orfu, Abaliget, Komlo, Sopron Area (Mihalyi et al. 1955: 348-362).

INDIA. Madras City (Senior-White 1923: 83); Calcutta (Li and Wu 1933: 105); Poona City, Manjri, Baramati (Rao and Rajagopalan 1957: 10); *Assam,* Golaghat, Khumtai, Nongpoh; *Central Provinces,* Pachmari; *Northwest Frontier,* Kohat, Abbottabad; *United Provinces,* Bhowali, Naini, Tal (Barraud 1928: 661); *Mardas,* North Arcot (Reuben 1971: 120); Nilgiri Hills, Kodaikanal (Barraud 1928: 662); Palni Hills (Barraud 1934: 255); Coonoor (Patton 1922: 67); Karachi (Hicks and Chand 1936: 520).

INDONESIA. *Celebes,* Banggaai (Brug and Haga 1923: 639); Bangsai (Haga 1924: 830); *Ternate* (Li and Wu 1933: 105); *New Guinea,* Kaimana, Manokwari, Merauke, Sorong, Tjof Island (Assem and Bonne-Wepster 1964: 101); *Java,* Weltevreden (Brug and Haga 1923: 639); *Borneo* (Edwards 1922b: 467); Ngabang (Haga 1924: 830); *Sumatra, Atchin,* Blang Kedjeren, Kotta Tjane, Takengon; *Benkoelen,* Air Prioekan; *Djambi,* Moeara Tebo; Krakatau

(Brug and Edwards 1931: 258); *Soemba*, Pajeti; *Timor*, Koepang (Haga 1924: 830); (Brug 1925: 668); *Sumba; Molaccas* (Bonne-Wepster 1954: 241); Bengaai; *Madoera* (Brug 1924a: 36); Kali Anget (Brug and Haga 1923: 639).

ITALY (Blanchard 1905: 310); Taranto (Li and Wu 1933: 105); *Sardinia Island*, San Vero Milis, Cabras, Orbai, Siliqua (Aitken 1954: 480); *Gorizia*, Gorizia (Balducci et al. 1968: 457).

LIBYA (Hamon et al. 1966: 378).

LOYALTY ISLANDS. Ouvea, Mare (Belkin 1962: 429).

MALAYSIA. *Selangor*, Ulu Gombak (McDonald and Traub 1960: 100); *Sarawak* (Moulton 1914: 47).

MARIANA ISLANDS (Bohart 1956: 59, Iyengar 1955: 45); *Guam; Saipan*, Magicienne Bay (Bohart and Ingram 1946: 41); *Guam*, Agat Bay, Dededo Ordot, Hilaan Point, Inarajan, Merizo, Nimitz Beach, Umatac (Hull 1952: 1291); *Guam* (Reeves and Rudnick 1951: 641, Yamaguti and La Casse 1950: 73); Umatac (Hu 1953: 125).

MARSHALL ISLANDS. *Ebon Island*, Ebon Atoll (Bohart 1956: 59, Bohart and Ingram 1946: 22).

MAURITANIA. *Assaba*, Diaguili; *Gorgol*, Belnabe, Kaldi, Rindiaw, Silla (Hamon et al. 1966: 373).

MAURITIUS ISLAND (Li and Wu 1933: 105).

MEXICO. *Chichahua*, Ciudad Juarez (Martini 1935: 50); *Guanajuato; Jalisco; Michoacan; Queretaro* (Vargas 1956: 21).

MOROCCO. Tazi Khemisset, Northern portion of country (Senevet and Andarelli 1954: 326).

NETHERLANDS (Blanchard 1905: 310, Theobald 1901a: 405).

NEW CALEDONIA. Houailon (Li and Wu 1933: 105, Buxton and Hopkins 1927: 91, Edwards 1924: 372); Tontouta (Laird 1956: 20); Ile des Pins (Belkin 1962: 429); Noumea (Williams 1943: 211); Bonde (Rageau and Hamon 1957: 377).

NEW HEBRIDES (Iyengar 1955: 43, Knight and Hull 1953: 462); Espiritu Santo (Perry 1946: 16); Efate, Emae (Belkin 1962: 429); *Aneityum*, Anelganhat; *Futuna*, Mission Bay (Laird 1956: 23).

NIGERIA. *Kano*, Kano; *Oyo*, Ibadan (Kumm 1931: 65, 73).

NORWAY. Os, Ringebu (Natvig 1948: 418).

PALAU ISLANDS (Stone et al. 1959: 198).

PHILIPPINES. *Bulaca*, Tunkong Manga; *Mindanao*, San Ramon; *Palawan*, Bacungam, Iwahig Penal Colony, Balsahen and Tacburos Rivers; *Samar*, Osmena; *Zambales*, Olongaop, Subic Bay (Knight and Hull 1953: 462); Tunkulan (Edwards 1929: 5); Clark AirBase, *Luzon, Pampanga* (Pippin 1965: 185; Dowell, Libay and Baisas 1965: 15); *Mountain*, Calaccad (Rozeboom and Cabrera 1964: 21).

POLAND. Warsaw (Lukasiak 1958: 770, 1961: 389, 1964: 87); *Wroclaw*, Kudawa (Lukasiak 1955: 301).

ROTUMA ISLAND (Belkin 1962: 429); Oinafa Village (Belkin 1965: 13).

REPUBLIC OF MAURITANIA. *Assaba*, Diaguili; *Gorgol*, Belnabe, Kaedi, Rindiaw, Silla (Hamon et al. 1966: 373).

RUMANIA. *Bukovina*, Upper Prut River (Lukasiak 1959: 358).

SAUDI ARABIA. Jeddah (Edwards 1941: 195); Madruga (Mattingly and Knight 1956: 119).

SCANDINAVIA (Blanchard 1905: 310, Theobald 1901a: 405).

SAMOAN ISLANDS. Lalomanu, Laulii, Mulifauna, Aleipata (Buxton and Hopkins 1927: 91); Savaii (Belkin 1962: 429, Bohart and Ingram 1946: 16).

SOUTH AFRICA. *Transvaal*, Warmbaths District (Muspratt 1955: 172).

SOUTHERN COOK ISLANDS. Rarotonga (?) (Belkin 1962: 429).

SOUTH VIETNAM (Borel 1930: 275); Bien Hoa, Phan Rang, Phu Cat, Pleiku, Tan Son Nhut, Tuy Hoa (Parrish 1968a: 2-5, 1969: 554); Chu Lai, Khe Sahn, Zui Nhon (Grothaus et al. 1971: 21).

SPAIN. El Escorial, Gibraleon, Mahon, Orense, Padul, Vigo, Guadarrama, Villacastin, Trobajo, Villadango, Sieteiglesias, Laguna, Motril, Pedrena, Villaverde (Clavero 1946: 22); Elche, Madrid, San Fernando (Seguy 1921: 25).

SUDAN. *Lado,* Bundle-Hierallah Area, Khor Nambiri, Nyumbe, Yidu, Such River (Theobald 1913b: 596); Khartoum (Lewis 1958: 151); Meidob-Kassala Area (Lewis 1947: 561); Jebelein (Lewis 1948: 152); Dueim, Abu Usher, Abu Ideima, Ezeirgab, Omdurman, Eilafun, Wadi Sidna, Hassa Heissa, Kassala, Kosti, Argo (Lewis 1945: 11); Abu Tabar, Danagla, Dilling, Dongola, El Fasher, Gereif, Khatmiya, Luing, Nofalab, Rahib Wells, Shambat, Uzeirgab, Zalingei (Lewis 1955: 168); *Darfur,* El Fasher (Abbott 1948: 43); Kadaro, Masiol, Wad Medani, Khartoum (Edwards 1941: 195); Bahr-el-Jebel (Theobald 1907: 196).

SWEDEN. Brunnby, Lerhamn, Ol, Raa, Vickleby (Natvig 1948: 418).

TAIWAN. *Tainan,* Hsinhua; *Taipei,* Tamshui (Lien 1962: 628); Takao (Edwards 1921a: 629); Ching Chaun Kang Air Base (Reisen et al. 1971: Table 17); Chao Chow, Hsin She (Hu and Grayston 1962: 140).

TANZANIA. *Zanzibar,* Pemba Island (Li and Wu 1933: 105).

THAILAND. Trang (Causey 1937: 414); Ban-U-Tapao, Nakhon Phanom, Takhli, Udorn (Parrish 1968b: 2-4); *Chieng Mai,* Doi Pui Mt. (Scanlon and Esah 1955: 139); Don Muang Air Base, Ubon (Reisen et al. 1971: Tables 6 and 7); *Kanchanaburi,* Sangkla-buri, Lai-nam, Ni-thae (Harinasuta et al. 1970: 241).

TOKALAU ISLANDS (Belkin 1962: 429).

TONGA ISLANDS (Knight and Hull 1953: 462, Iyengar 1960: 67); Nukualofa (Li and Wu 1933: 105, Edwards 1924: 372, Buxton and Hopkins 1927: 91); Niutao, Niuatobutabu (Bohart and Ingram 1946: 16); *Tongatabu,* Fanga Uta Lagoon, Kuku Alofa (Laird 1956: 37); Niuafoou (Belkin 1962: 429).

TUNISIA. Oglet Hachina (Senevet and Andarelli 1954: 326); Nefzaoua (Senevet et al. 1954: 273).

TURKEY (Parrish 1959: 266).

U. A. R. *Egypt* (Li and Wu 1933: 105).

U. S. A. *Connecticut; Delaware; Kansas; New Hampshire; Rhode Island; Vermont; West Virginia; Wyoming* (Carpenter and La Casse 1955: 264); *Hawaiian Islands,* Kauai Island, Oahu Island (Joyce and Nakagawa 1963: 273).

U. S. S. R. (Theobald 1901a: 405); Asov, Woronesch (Stschelkanovzev 1926: 134); Southern Karelia (Natvig 1948: 418); Widely distributed from the Siberian forest zone to the southern boundary and in the east to Sakhalin and Kamchatka; sporadically found in the north in the Nenetsky National District along the lower course of the Pechora River (Monchadskii 1951: 234); Kazakhstan, *Siberia* (Gutsevitch et al. 1970: 273).

WALLIS ISLANDS. Uea (Belkin 1962: 429).

WESTERN SAMOA. *Upolu,* Apia (Laird 1956: 28).

WEST INDIES (Li and Wu 1933: 105).

WEST PAKISTAN. Lahore (Ansari 1959: 25).

YUGOSLAVIA. Skoplje (Li and Wu 1933: 105).

Natvig (1948: 418-420) lists a distribution for *vexans vexans* occurring outside Denmark and Fennoscandia.

Graham (1939: 213) identified a single collection of larvae as *vexans*

that was found "in a tin of water jammed among rocks just above high tide at Russell," New Zealand. Belkin (1968: 113) thinks this collection is probably *Aedes (Finlaya) notoscriptus* (Skuse) and not *vexans*.

TAXONOMIC DISCUSSION. *Aedes vexans vexans* is similar in the adult habitus and male genitalia to *vexans nipponii, davidi, stenoetrus* and *syntheticus*. It has several smaller differences from *vexans nipponii* but the most pronounced one is the scaling of the abdominal terga (see couplet 11 of the adult key for this separation). *Aedes vexans vexans, vexans nipponii* and *stenoetrus* have femora II with a number of white scales randomly intermixed with brown ones on the anterior surface while in *syntheticus* the anterior surface of femur II is brown with a median row of distinct white spots. The proboscis of *stenoetrus* is completely covered with dark brownish-black scales while the other 3 members of the group have white scales on the proboscis (usually in great numbers ventrally). *Aedes stenoetrus* probably has a restricted distribution in the mountains of Ceylon and southern India at elevations above 4,000 feet while *vexans vexans* has a very wide distribution and occupies a great variety of elevations. Differences from *davidi* are discussed under that species. The basal mesal lobe of the male genitalia of *syntheticus* has 4 flattened blade-like and 1 long bristle while those of *vexans vexans* and *vexans nipponii* have 25-38 short bristles and *stenoetrus* has 118-128 bristles. The adult habitus of *vexans vexans* has a semblance to *caecus* which is discussed under that species. *Aedes (Ochlerotatus) vigilax* is very similar to *vexans vexans* and *vexans nipponii* in the adult habitus and is often confused with them but can be separated from these 2 species by the presence of a small patch of broad white scales on the mesepisternum immediately below the prealar knob and by the absence of scales on the subspiracular area. The aedeagus of the male genitalia of *vexans vexans* and *vexans nipponii* is toothed while *vigilax* has a simple tube.

The female genitalia of *vexans vexans, vexans nipponii, syntheticus* and *stenoetrus* are very similar except that the latter species has a number of scales scattered over the dorsal surface of the cerci. Females of the Oriental *vexans* group of species have a few narrow scales ventrally on the prosternum. The 2 subspecies of *vexans* also have 1-3 bristles on the prosternum and have the insula of the genitalia without tuberculi. These features of the prosternum and insula differ from the other species of Oriental *Aedimorphus*.

The features of the pupal stages of *vexans vexans* and *vexans nipponii* tend to overlap and therefore cannot be separated with certainty.

The larva of *vexans vexans* in Southeast Asia has the frontoclypeus of the head granulose while this area in *vexans nipponii* is nongranulose.

In North America, Crans and Gander (1968: 235) reported finding a few female specimens of *vexans vexans* from Delaware, Ohio and New Jersey which displayed abdominal and pleural markings similar to those of the subspecies *nipponii*. During the 1971 Venezuelan equine encephalitis outbreak in the southern United States, there were 13,600 female specimens of *vexans vexans* examined from Arkansas, Louisiana, Oklahoma and Texas by U. S. Army taxonomists and only 26 of these were of the abnormal type resembling *nipponii*. I have also examined 8 females from Worcester County, Maryland, 1 female from Valdosta, Georgia and 1 female from Portland, Oregon of this form. No males or females with associated immatures of the abnormal type have been collected. The females differ from *nipponii* in lacking scattered white scales on the dorsal wing veins and a reduction in the number of pale scales on the maxillary palpi and legs. A possible explanation for this form being encountered so infrequently is that in North America it is a

recessive genotype of *vexans vexans* that has a very low frequency.

Belkin (1962: 427) gave full species status to the members of *vexans* occurring on the Pacific Islands and based this determination on the branching of the larval head hairs 5, 6-C and minor differences in the adult habitus. After examining specimens of *vexans vexans* from a number of areas in its range (see DISTRIBUTION) I found that the species is extremely variable in the size and habitus of the adults and the chaetotaxy of the immatures. Barr (1954: 24) also records the variability of the larval head hairs 5, 6-C of *vexans vexans*. Specimens of *vexans vexans* many times exhibit a noticeable variation within local populations as well as variances between geographical populations. In one collection of larvae (with reared adults) from Mindoro, Philippines both head hairs 5 and 6-C ranged from both single to 5-C double and 6-C triple with all combinations between these extremes. In collections from New Guinea, South Vietnam, Hong Kong and Thailand, I found the same variability and in some cases even greater variations. The 2 female syntypes of *nocturnus* in the British Museum (Natural History) and other specimens from the Pacific Islands that I have examined seem to fall within the normal variation of characters of adult habitus, female and male genitalia, and pupal and larval chaetotaxy of *vexans vexans* from the remainder of its distribution. In the absence of sufficient biological, behavioral and genetical data on the Pacific Island populations of *vexans*, and since specimens from these populations fall within the variable range of morphological characters of other populations within the distribution of the species, I am hereby synonymizing *nocturnus* with *vexans vexans*.

BIOLOGY. The immatures have been collected from a variety of habitats but appear to prefer unshaded, fresh water flood pools in secondary scrub, open plains and rice fields. Adults have been taken feeding on man and domestic animals. Immatures in Thailand have usually been collected from large and small flood pools but also from a large rice field, small and large ditches, small swamp, abandoned posthole, and elephant footprint; usually from clear fresh water but occasionally from colored turbid fresh water; water usually with scarce floating and emergent aquatic vegetation or scarce green algae; in partial shade or unshaded areas; in rice fields and coconut groves in plains, banana grove in valley, banana grove, secondary scrub, primary bamboo grove and primary rain forest in mountains; and at an altitude from 7 to 1, 640 feet (most often at 50 to 600 feet). Larvae were collected in association with the following species of mosquitoes: *Aedes alboscutellatus, caecus, lineatopennis, mediolineatus; Anopheles kochi, subpictus, vagus; Culex fuscanus, gelidus, mimulus, sitiens, tritaeniorhynchus;* and *Uranotaenia bicolor*. In New Guinea, Peters and Christian (1963: 48, 64) found larvae associated with the following species: *Anopheles farauti, Culex fraudatrix* group, *mimulus* and *pullus* in the lowlands and *Anopheles annulipes, farauti, Culex miraculosus* and *quinquefasciatus* in the highlands.

Immatures were collected from: ground pools, swamp, ditch, foxhole, rice field, marshy depression and seepage spring in South Vietnam; temporary puddle, flood pool, grassy pool, fish pond, sunlit ground pool, small flooded area near road, ditch, rain pools in pasture, carabao wallow and an open muddy algae-filled pond in the Philippines; hoofprints in Fiji; ground pool in Taiwan; ground pool in a fallow rice field with abundant grass and scarce green algae and associated with *Anopheles tessellatus* in Hong Kong; ground pools in India; stagnant water in a roadside ditch in Burma; and in sunlit ground pool, artificial container, brackish water pool and pools in alang-alang in Indonesia. Adults were taken biting man, cattle and horses, in light traps, resting in houses and

bamboo forests in Thailand; biting man and in light traps in the Philippines and South Vietnam; in Malaise traps at an elevation of 10 feet in Ceylon; and in houses in Indonesia.

Immatures have been recorded in the literature from the following habitats: cisterns, rain barrels, pottery, coconut husks, carabao wallows, standing water, rice fields, pools with lilies (Dowell, Libay and Baisas 1965: 30), temporary rain puddles, grassy swamps, drainage ditches (Perry 1946: 16, Knight and Hull 1953: 462) and from a tin can (Basio et al. 1970: 443) in the Philippines; unshaded pools and ditches, in salt, brackish or fresh water (Assem and Bonne-Wepster 1964: 101), artificial containers, hoofprints, pools, ponds and ditches (Steffan 1966: 212) in New Guinea; clear water pools containing grass in Guam (Yamaguti and La Casse 1950: 78); in ditches and ponds in Malaysia (Macdonald 1957: 21); in ground pools and artificial receptacles in Thailand (Causey 1937: 414); newly flooded rice fields and ground pools in Taiwan (Lien 1962: 628); seepage ditch water, marshes, temporary grassy pools, ponds, ditches and ground depressions in South Vietnam (Grothaus et al. 1971: 21); and ground pools in China (Chow 1949: 129). Adults have been taken in indoor shelters in India (Rao and Rajagopalan 1957: 10); feeding on cattle (Macdonald 1957: 21), and in an indoor evening catch (Macdonald 1956: 233) in Malaysia; readily biting man in the daytime and collected at elevations from 33 to 1, 300 feet (Basio et al. 1970: 438, 443), commonly taken while trying to bite humans at night and from a light trap (Knight and Hull 1953: 462) in the Philippines; females biting man, cows and buffaloes at night in Taiwan (Lein 1962: 628); in light traps, CO_2 traps, indoor resting sites and biting man in South Vietnam (Grothaus et al. 1971: 21); and in light traps and biting man indoors at night in New Guinea (Peters and Christian 1963: 44, 55). In Thailand *vexans vexans* were collected that had fed on bovines and chickens (Unpublished data from SEATO Medical Research Laboratory Annual Progress Report 1967: 450) and in scrub or open forests, in heavy forest and at elevations from 1, 000 to 4, 500 feet (Scanlon and Esah 1965: 139, 143). Templis et al. (1970: 339) summarized the feeding preferences of *vexans vexans* in the Hawaiian Islands as follows: man--2. 4 percent, bovine--50. 7 percent; horse--37. 2 percent; dog--4. 7 percent, pig--1. 6 percent and unknown host--3. 4 percent. In Malaysia, Standfast (1967: 193) found that *vexans vexans* readily fed on man between 1800 and 0600 hours with a peak in feeding around 2400 hours and a smaller one around 0500 hours. Laird (1956) records *vexans* collections from a number of localities in the South Pacific, notably from transient pools (Ellice Island, New Hebrides, Western Samoa); ponded ditches (Tonga, New Caledonia); pond in forest clearing (Belep Island); road ruts (Fiji, New Hebrides); taro ponds (Ellice Islands, Gilbert Islands); seepage pond (Tonga); and a small seepage pond with decomposing grass clippings (Western Samoa).

Eggs of *vexans vexans* are deposited in shallow areas that are subject to inundation. Horsfall (1956: 66) found that embryonated eggs of *vexans vexans* are able to withstand adversities such as drought, cold and premature submersion often for long periods of time. He also stated that eggs subjected to adversities required "conditioning" prior to the basic hatching stimulus. The hatching stimulus is a decrease in the content of dissolved oxygen in the water. Gjullin, Yates and Stage (1950: 268) reported that eggs in field cages showed little or no mortality over 2 years, but for longer periods viability rapidly decreased and less than 1 percent survived 4 years. Eggs of *vexans vexans* deposited 1 year may hatch throughout the following season but usually most eggs that survive the winter hatch the following spring (Miller 1930 cited in Horsfall 1955: 523). Horsfall (1955: 523) stated that eggs in natural sites can

withstand prolonged freezing without detrimental effects.

AEDES (AEDIMORPHUS) VEXANS NIPPONII (THEOBALD)
(Figs. 15, 16, 17, 32, 48, 58, 69)

Culicada nipponii Theobald 1907, Monogr. Cul. 4: 337 (♀*).
Ochlerotatus vexans variety *nipponii* Theo., Edwards 1917, Bull. ent. Res. 7: 219.
Ochlerotatus vexans Mg., Brunetti 1920 *(in part)*, Rec. Indian Mus. 17: 135; Senior-White 1923 *(in part)*, Cat. Indian Insects, Cul., p. 83.
Aëdes (Ecculex) vexans variety *nipponii* Theobald, Edwards 1921, Bull. ent. Res. 12: 322.
Aëdes vexans var. *nipponii* Theobald, Ho 1931, Bull. Fan meml. Inst. Biol. 2: 131 (♂*, ♀).
Aëdes (Aëdimorphus) vexans var. *nipponii* Theobald, Edwards 1932, Genera Insec., Fasc. 194: 171.
Aëdes (Aëdimorphus) vexans (Meigen), Barraud 1934 *(in part)*, Fauna Brit. India, Diptera 5: 253.
Aedes (Aedimorphus) vexans Meigen, Feng 1938, Peking nat. Hist. Bull. 12: 291; Hsiao 1945, Navmed. 630, p. C6.
Aedes (Aedimorphus) vexans nipponii (Theobald), Bohart 1946, U. S. Navmed. 961, p. 10; Bohart and Ingram 1946, U. S. Navmed. 1055, p. 69 (♂*, L*); Hsiao and Bohart 1946, U. S. Navmed. 1095, p. 22; La Casse and Yamaguti 1947, Mosquitoes Japan, 2: 39(L*); La Casse and Yamaguti 1948, Mosquito Fauna Japan and Korea, p. 100 (♂*, ♀*, P*, L*); La Casse and Yamaguti 1950, Mosquito Fauna Japan and Korea, p. 125 (♂*, ♀*, P*, L*); Yoshimeki 1955, Ecol. Rev., Jap. 14: 81 (L*); Hara 1957, Jap. J. exp. Med. 27: 66 (♀*); Stone et al. 1959, Thomas Say Found. 6: 199; Kurihara 1963, Jap. J. sanit. Zool. 14: 196 (A*).

FEMALE (Fig. 15). *Head.* Antenna dark brown, approximately 0.88 length of proboscis, pedicel pale with a number of small white scales and a few short fine brown hairs mesally, flagellomere 1 pale with a few dusky scales; clypeus dark, bare; maxillary palpus brown scaled with white scales at base of segment 4 and at base and apex of segment 5, usually several white scales scattered over segments 3-5, approximately 0.20 length of proboscis; proboscis brown scaled with a broad longitudinal ventral stripe from near base to apical 0.25, stripe extends up lateral surfaces and onto dorsolateral areas, in some specimens the stripe forms a nearly complete band, apical 0.25 always dark brown, approximately 1.26 length of femur I; vertex with dorsum covered with narrow decumbent scales arranged in a small anteromedian diamond-shaped golden-brown group and the remainder white, narrower white scales on posterior margin of occiput; lateral surface covered with broad scales, an anterodorsal black patch with white ones below; numerous long golden-brown erect forked scales on occiput and vertex extending anteriorly to ocular line. *Thorax.* Scutal integument dark brown; scutum covered with narrow curved reddish-brown scales (specimens from Japan have scales golden-brown), narrow curved white scales forming patches on anterior promontory area, scutal fossal area extending from anterior area along margin and onto lateral area, supra-alar area from above middle of paratergite to posterior of wing base, posterior median scutal area, along lateral margins of prescutellar space and among posterior dorsocentral setae; scales nearly cover prescutellar space in some specimens;

scutellum with a patch of narrow curved white scales on each lobe; median anterior promontory, acrostichal, dorsocentral (anterior and posterior), scutal fossal (anterior, 4-5 lateral, 1-3 median and 1-6 posterior), supra-alar, several posterior medial scutal, 1 postalar callar and scutellar (lateral and median) bristles reddish-brown and well developed; pleural integument brown; antepronotum covered with narrow curved white scales, several golden and brown bristles; postpronotum covered with narrow curved reddish-brown scales, a small posteroventral patch of narrow curved and usually a few broad white scales, 8-9 posterior dark bristles; propleuron with a patch of broad white scales, several golden bristles; prosternum with narrow white scales and 1-3 bristles; postspiracular area with a patch of moderately broad white scales, 7-11 golden bristles; subspiracular area with 2 patches of broad white scales, lower one large and frequently connected with postspiracular patch; mesepisternum with a large upper and a posterior patch of broad white scales, patches usually connected or nearly so, several upper and posterior golden bristles, lower ones shorter; prealar knob with a few broad white scales on lateroventral margin, several golden bristles; paratergite covered with white scales, scales vary in shape, some specimens with broad ones, some with narrow curved ones and some with both; mesepimeron with a large patch of broad white scales and several golden bristles on upper area; other pleural areas bare. *Legs* (Fig. 16). Coxae I-III each with several brown to golden bristles, I, II each with anterior surface white scaled, I with a patch of brown scales at middle, III with an anterodorsal and an anteroventral patch of white scales; trochanters I-III each with a patch of broad white scales; femora I-III each with anterior surface brown and with a dorsoapical white spot, I-III each with a narrow basal white band and numerous scattered white scales, I with 30-60 percent of scales white, III with a broad longitudinal white stripe tapering from base to apical 0.25, remainder with scattered white scales; femora I-III each with posterior surfaces white, I with scattered brown scales on posteroventral area, II, III each with scattered brown scales on apical 0.25; tibiae I-III each with a few scattered white scales and a narrow basal white band, I with ventral and posterior areas white, II with dorsal and posterior areas white, a small brown area on dorsal surface at base and at apex, III with a posterior longitudinal pale stripe; tarsi I-III brown, I with tarsomeres 2, 3 each with a narrow basal white band, tarsomere 1 and basal 0.50 of tarsomere 2 with a posterior longitudinal pale stripe, II with tarsomeres 1-4 each with a narrow basal white band, tarsomeres 1-2 each with a posterior longidudinal pale stripe, tarsomere 5 with a few laterobasal white scales, III with tarsomeres 1-5 each with a narrow basal white band, tarsomere 1 and basal 0.50 of tarsomere 2 with a posterior longitudinal pale stripe; posttarsi I-III each with 2 ungues, I, II equal, each bearing a tooth, III equal, simple, occasionally each with a tooth. *Wing*. Dorsal veins covered with moderately broad brown scales; costa with a patch of white scales at base and along basal 0.50 of its posterior margin; subcosta, radius, cubitus and occasionally anal veins with a few white scales intermixed on basal 0.50; ventral veins brown with some white scales on posterior margin of costa and on subcosta at humeral cross vein; alula with narrow brown scales along fringe; 2-3 remigial bristles. *Halter*. Pedicel pale, capitellum white scaled. *Abdomen*. Terga brown with somewhat variable white markings; tergum I with dorsum white with a few intermixed lateral brown scales, laterotergite with a rectangular patch of white scales; tergum II with a large basomedian triangular white patch; terga III-VI each with a dorsobasal white band, bands very broad laterally and becoming narrower mesally, III-V each with an incomplete median apical longitudinal

white stripe which may or may not connect with basal bands; terga VI, VII varies from each with a large dorsoapical triangular white spot and VII with a pair of small basolateral triangular white patches on dorsum to VI, VII each white with a dorsal brown V-marking pointing anteriorly; terga II-VII each with a large laterobasal white patch which may nearly cover lateral surfaces but is not connected with dorsobasal bands; sterna white scaled with brown scales forming a narrow indistinct longitudinal stripe on III-VII, terga and sterna with numerous golden bristles, mostly along posterior margins. *Genitalia* (Fig. 32). Tergum VIII index 0.92-0.99; sternum VIII index 0.88-0.97; tergum IX bilobed with 4-8 bristles on each lobe, index 0.85-1.02; insula tongue-like, covered with minute setae; lower vaginal lip narrow, moderately pigmented, covered with minute setae; upper vaginal lip narrow, heavily pigmented, covered with minute setae; upper vaginal sclerite large, moderately pigmented, triangular shaped; postgenital lobe moderately long, apex with a moderately deep median indentation, 5-8 bristles on each side of midline, covered with minute setae, dorsal PGL index 0.75-0.91, ventral PGL index 1.55-1.87; cercus moderately long to long, 0.90-1.00 extended from segment VII, narrow, apex sharply rounded, numerous bristles on dorsal and lateral surfaces, index 3.08-3.59, cercus/dorsal PGL index 4.34-5.20; 3 spherical, pigmented seminal capsules, 1 large and 2 slightly smaller ones.

MALE (Fig. 15). Similar to female in general habitus. *Head.* Maxillary palpus brown with segments 2, 4, 5 each with a dorsobasal white spot, segment 3 with a basal white band, longer than proboscis by length of apical segment; vertex with anteromedian narrow golden-brown scale patch and anterodorsal broad black scale patch reduced. *Thorax.* Prosternum bare. *Legs* (Fig. 17). Tarsi I-III with posterior longitudinal stripes reduced; posttarsi I-III each with 2 ungues, I, II with ungues unequal, each bearing a tooth, III equal, simple. *Abdomen.* Terga II-VI with basal white bands which are expanded posteriorly on lateral surfaces, VII with large lateral triangular patches nearly connected medially, III-V with median apical longitudinal white stripes reduced to a few pale scales in some specimens; tergum VIII white; sternum VIII white with a median longitudinal brown band. *Genitalia* (Fig. 48). Nearly identical to those of *Aedes vexans vexans.*

PUPA (Fig. 58). Chaetotaxy as recorded in Table 10. Two to three rows of spicules mesally along posteroventral margin of abdomen II. *Cephalothorax.* Hair 5-C with 2-4 branches; 7-C with 2-4 branches; 8-C with 3-6 branches. *Respiratory trumpet.* Moderately pigmented; index 2.89-3.82, average 3.26. *Metanotum.* Hair 10-C with 4-10 branches; 12-C single to triple. *Abdomen.* Hair 5-I with 2-5 branches; 10-I single; 1-II with 4-10 branches; 4-II with 2-4 branches; 1-III with 3-6 branches; 6-VI single or double; 1-VII single to triple; 6-VII with 3-5 branches; 9-VII with 2-4 branches; 11-VII single to double. *Paddle.* Ovoid; with very minute serrations along basal 0.55 of outer margin; tiny spicules along apical 0.45 of outer and apical 0.30 of inner margins; midrib does not reach apex; hair 1-P short, single or double; index 1.42-1.82, average 1.59.

LARVA (Fig. 69). Chaetotaxy as follows: *Head.* Frontoclypeus without granules; median mouth brushes pectinate apically; hairs 1, 3, 8-C single; 4-C with 2-4(4) branches; 5-C single to 4(3) branched; 6, 14-C single or double (1); 7-C with 7-12(9) branches; 9, 10-C single or double (2); 11-C with 4-10(7) branches; 12-C with 4-7(5) branches; 13-C single to triple (2); 15-C with 4-6 (4) branches; basal maxillary hair single; mental plate with 25-27(26) teeth. *Antenna.* Short and moderately to heavily pigmented; with small stout spicules scattered over shaft, most numerous on basal 0.50; hair 1-A with 5-10(6)

branches, inserted 0.38-0.45 from base; 2-A long; 3-A approximately 0.50 length of 2-A. *Thorax.* Hair 0-P with 3-6(5) branches; 1, 2, 4-6, 9, 10, 12-P single; 3-P double or triple (2); 7-P double or triple (3); 8-P with 2-4(3) branches; 11-P single to triple (2); 14-P single or double (1); 1, 2, 4-M with 2-4(3) branches; 3, 11-M single or double (1); 5, 7, 10, 12-M single; 6-M with 5-6(5) branches; 8-M with 5-7(6) branches; 9-M with 6-7(6) branches; 13-M with 5-9(7) branches; 14-M with 4-6(5) branches; 1-T single to triple (2); 2-T double or triple (3); 3-T with 2-7(6) branches; 4-T with 2-5(4) branches; 5, 6, 10, 12-T single; 7-T with 6-11(7) branches; 8, 9-T with 4-6(5) branches; 11-T single or double (1); 13-T with 5-8(5) branches. *Abdomen.* Hairs 1, 2-VIII on common basal plate; hairs 0, 14-VIII single; 1-VIII with 4-12(8) branches; 2, 4-VIII double or triple (2); 3-VIII with 5-12(8) branches; 5-VIII with 6-9(9) branches; 6-III-VI long; comb of 9-11(9) scales arranged in 1-2 irregular rows, scales with a long stout pointed median spine and short denticles along lateral margins of base; 1-X single or double (1); 2-X with 6-9(8) branches; 3-X single; ventral brush with 11-13 (usually 11) hairs on grid and 3 precratal ones; saddle moderately pigmented with minute ridges, incompletely rings segment, with small spicules along posterior margin, acus present; 4 anal papillae, long and tapering to a blunt point. *Siphon.* Moderately pigmented with minute ridges over entire surface; acus large; index 2.42-3.86; pecten with 9-11(9) teeth, apical 2-3 teeth longer, smooth or with a minute lateral denticle and wider spaced than remainder which have a slender apical attenuated filament with 1-3 basal denticles; hair 1-S with 5-7(5) branches, inserted 0.57-0.64 from base.

TYPE DATA. *Culicada nipponii* Theobald, holotype female, Karnizana, JAPAN, 25 August 1903, Mr. Cornford, in British Museum (Natural History).

DISTRIBUTION. Specimens examined--51 males, 115 females, 30 pupae, 121 larvae and 33 individual rearings (5 pupal, 28 larval) from the following locations:

CHINA. Kiangsu, Peking, Shanghai, Yenching; *Manchuria,* Mukden, Tetsusci.

JAPAN. Karnizana; *Saitama,* Honshu, Sagiyama; *Kanagawa,* Inada; Tokyo.

RYUKYU ISLANDS. *Ishigaki Is.*, Inota III; *Okinawa,* Dyama, Ganiko, Kuba, Myiazato, Naha, Oyama; *Miyako Is.*

SOUTH KOREA. Koje-do, Seoul, Taegu.

Other distribution.

CHINA. *Honan,* Kai Feng, Chi Kung Shan, Hsin Yang (Su and Ch'ii 1956: 219); *Hopei* (Ma and Feng 1956: 172); *Yunnan,* Chefang (Chow 1949: 129); *Chekiang,* Hangchow, Hwangyen, Iwui Pingyang, Tienmushan; *Kiangsu,* Shanghai, Nanking; *Kwangtung,* Canton, Swatow; *Liaoning,* Hailung; *Tibet,* Chumbi Valley; *Yunnan,* Gadzu Beta (Feng 1938: 291); (Gutsevitch et al. 1970: 274).

JAPAN. *Hokkaido,* Sapporo; *Honshu,* Yodo; Sendai (La Casse and Yamaguti 1950: 129); Asahikawa, Kagoshima (Hara 1957: 66); Tokyo, Katsushika Ward (Sasa et al. 1950: 511); *Hokkaido* (Sasa et al. 1947: 53); *Okayama* (Sasa and Sabin 1950: 24); Nagasaki City (Ito 1964: 232); Tomachi, Mogi, Kaizu, Koebaru (Shichijo et al. 1970: 94); Karnizana (Theobald 1910b: 301); Sagiyama, Shinhama (Scherer et al. 1962: 261); *Hokkaido,* Sendai, Tokyo (Hsiao and Bohart 1946: 22); *Nagasaki* (Omori et al. 1952: 281); *Fukui,* Tadasu-Mura (Omori 1951: 310); *Okayama,* Tokoku (Sasa 1949: 99); *Tochigi,* Shiobara, Tomatsuri, Utsunomiya (Kurashige 1964: 75, 84, 94); Funaoka (Kato and Toriumi 1950: 468); Itazuke AB, Misawa AB, Tachikawa AB, Yokota AB (Reisen

et al. 1971: Tables 23 and 24).

SOUTH KOREA. Kimpo AB, Kunsan AB, Kwang-Ju AB (Reisen et al. 1971: Tables 26 and 27); Seoul City, Hyangdangdong (Chu 1957: 5); *Cheju Island,* Daejong Up, Mosulpo (Oh et al. 1961: 85).

U. S. S. R. Kharbarovsk Area, Baikal Area (Gutsevitch et al. 1970: 274).

TAXONOMIC DISCUSSION. *Aedes vexans nipponii* is similar in the adult habitus, female and male genitalia, pupa and larva to *vexans vexans* and is discussed under that species.

BIOLOGY. Immatures have been found in a wide range of habitats but seem to prefer unshaded fresh water, flood pools and rice fields. Adults have been taken feeding on man both during the day and night. Larvae were collected on Okinawa from ground pools, rice field, stream, swamp, ditch and a small pond.

Immatures have been collected from natural water pools and swamps in China (Feng 1938: 291), from Japanese decorative garden pools, rice field ditches, stone urn, bamboo stump, small cup and seepage pool from broken pipe in Japan (La Casse and Yamaguti 1947: 40) and from temporary, partially shaded, fresh water ground pools containing leaves in Okinawa (Bohart and Ingram 1946: 69). In Japan larvae of *vexans nipponii* were collected from rice fields in association with *Culex pipiens, tritaeniorhynchus, orientalis, hayashii, bitaeniorhynchus* and *Aedes dorsalis* (Kato 1956: 157). The adult feeding period in Japan of this species extended from 1600 to 0700 hours with a peak feeding time from 1730 to 2200 hours (Kato and Toriumi 1950: 468). Sasa (1949: 101), while working in Japan, collected adults very early in the spring and believes that this species hibernates as adults during the winter. Adults were taken both during the day and night biting man in Japan (La Casse and Yamaguti 1948: 104, 1950: 129).

AEDES (AEDIMORPHUS?) WAINWRIGHTI BAISAS

Aedes (Aedimorphus) wainwrighti Baisas 1946, Mon. Bull. Bur. Hlth. Philipp., Manila 22: 34 (♀); Knight and Hull 1953, Pacif. Sci. 7: 464 (♀); Stone et al. 1959, Thomas Say Found. 6: 199.

FEMALE. *Head.* Antenna dark brown, pedicel dark with a small patch of broad silvery scales mesally; clypeus dark brown, bare; maxillary palpus dark brown scaled, approximately 0. 17 length of proboscis; proboscis dark brown scaled, slightly shorter than femur I; vertex and lateral surface covered with broad decumbent scales, dorsum with an anteromedian triangular patch of silvery scales that broadens anteriorly and extends as a fine line along eye margin, a dark scaled spot laterad of median spot, remainder of vertex and lateral surface pale brownish (almost whitish under different lighting); narrow dark scales and a few erect scales on occiput. *Thorax.* Scutal integument brownish; scutum covered with narrow dark brown scales with a broad median silvery line on anterior 0. 50; scutellum with broad silvery scales on median lobe; a pair of dorsocentral bristles toward anterior border and a stronger pair above level of wing bases, 2 pairs of prescutellars (posterior dorsocentral bristles), rather few supra-alars and scutellar (lateral and median) bristles; pleural integument darker brown than scutum; antepronotum with a small patch of silvery flat scales, about 7 stiff, tawny bristles; postpronotum with 3 tawny bristles, but

without scales; propleuron with a round patch of silvery scales, 4-5 tawny bristles; postspiracular area with 6 tawny bristles; subspiracular area with a narrow elongate patch of silvery scales astride suture between this area and mesepisternum; mesepisternum with a fairly large round upper patch and a lower one of silvery scales, 1 upper and 3-4 lower (posterior) tawny bristles; prealar knob with 4-5 tawny bristles; paratergite covered with a dense patch of broad silvery scales; mesepimeron with a patch of silvery scales and several weak bristles on upper area. *Legs*. Coxae I-III each with an elongate patch of silvery scales; femora I-III each dark brown with ventral surface and base pale, II with an apical silvery spot, III with basal 0.50 of anterior and posterior surfaces pale and a large apical silvery spot; tibiae I-III each dark brown; tarsi I-III each dark brown with a white basal band on tarsomere 1, band indistinct on I, marked on II and apparently still wider on III as indicated by the remaining portion of the tarsomere. *Wing*. Dark scaled. *Abdomen*. Terga dark scaled; tergum I with laterotergite silvery scaled; terga II-VII each with a laterobasal patch of silvery scales (patches broadened, basally), patches visible dorsally on V-VII; sterna III-VII pale with posterior portions dark scaled. *Genitalia*. Tergum VIII completely retracted into segment VII.

MALE, PUPA and LARVA. Not known.

TYPE DATA. *Aedes (Aedimorphus) wainwrighti*, Baisas, holotype female, Llavac, Infanta, Tayabas, *Luzon*, PHILIPPINES, 29 May 1940, Mr. Pablo Sunico, collected in a mosquito trap; holotype nonexistent (Stone 1970: 151).

DISTRIBUTION. Known only from type locality.

TAXONOMIC DISCUSSION. The above description has been adapted from the original one by Baisas (1946).

Aedes wainwrighti possesses a number of features that differ from other species of *Aedimorphus* in the Oriental Region. The most marked differences are: pedicel with a patch of broad silvery scales mesally; erect scales of head restricted to occiput; vertex of head with dorsum covered with broad decumbent scales (*punctifemoris* is the only other Oriental species of *Aedimorphus* with this character); reduction in number or absence of anterior dorsocentral bristles; absence of acrostichal bristles; presence of a broad median line of silvery scales on anterior 0.50 of scutum; scutellum with broad silvery scales only on median lobe; and pleural integument dark brown. These features are more suggestive of *Stegomyia* than of *Aedimorphus*.

Even with these differences there are characters shared by other Oriental *Aedimorphus* and since the type has been lost, the male has never been found and no new material has been collected, I am for the present doubtfully retaining *wainwrighti* in this subgenus.

BIOLOGY. The holotype was collected in a mosquito trap.

MISIDENTIFICATIONS and DOUBTFUL RECORDS

AEDES (AEDIMORPHUS) STENOETRUS (THEOBALD)
(Figs. 12, 16, 17, 29, 45)

Culex stenoetrus Theobald 1907, Monogr. Cul. 4: 395 (♀).
Culex pseudostenoetrus Theobald 1910, Monogr. Cul. 5: 343 (♀*).

The original record of this species from Southeast Asia was that of Thurman and Thurman (1955: 222) from Chiengmai, Thailand. Two females

determined by the Thurmans as this species from Chiengmai were found in the United States National Museum. They are actually *Aedes vexans vexans*. Additional material in the U. S. National Museum labeled as *stenoetrus* from Assam, India, were a mixture of *vexans vexans* and *caecus*. No specimens of *stenoetrus* from Southeast Asia were found in the collections of the U. S. National Museum (Natural History) and the British Museum (Natural History).

A discussion of distinguishing characters of *stenoetrus* is presented in the taxonomic discussion section of *Aedes vexans vexans* and the adults are illustrated (Figs. 12, 16, 17, 29, 45) in order to help field workers recognize this species.

AEDES (AEDIMORPHUS) TAENIORHYNCHOIDES (CHRISTOPHERS) (Figs. 13, 16, 17, 30, 46)

Pecomyia maculata Theobald 1905 (*non* Meigen 1804), J. econ. Biol. 1: 23 (♀*) (name preoccupied).
Leslieomyia taeniorhynchoides Christophers 1911, Paludism 2-3: 68 (♂, ♀).

The following published records of *Aedes taeniorhynchoides* from Southeast Asia are misidentifications or are doubtful records:

CHINA (Feng 1958: 74); *Hainan Island* (Chu 1957: 158, 1958: 109).

THAILAND (Thurman 1959: 121, 1963: 54); *Chiengmai*, Chiengmai (Scanlon and Esah 1965: 139); Korat, Nakhon Phanom, Takhli, Udorn (Reisen et al. 1971: Tables 4, 5 and 7).

SOUTH VIETNAM. Phan Rang (Parrish 1968a: 3); Nha Trang (Parrish 1969: 554); Cam Rahn Bay, Phu Cat, Tan Son Nhut (Reisen et al. 1971: Tables 11, 12 and 13); Chu Lai, Da Nang, Phu Bai (Grothaus et al. 1971: 20).

The original record of this species from Thailand was that of Thurman (1959) and although the locality data were not included the material upon which the report was based was probably collected in northern Thailand. Nine females determined as *Aedes taeniorhynchoides* were found in the Thurman collection in the United States National Museum (Natural History) and contained the following data: Doi Chom Chen, Chiengmai, Chiengmai Province, Thailand, IV-7-1952, Det. D. & E. Thurman. All nine of these specimens are *Aedes vexans vexans*. I have also seen a number of specimens from Thailand deterby Scanlon and co-workers as *taeniorhynchoides* but they are *Aedes vigilax*. Five females labeled *taeniorhynchoides* from South Vietnam were also *vigilax*. Since I have not found any *taeniorhynchoides* in the large numbers of specimens from the Malayan, Thailand and South Vietnam collections and since the above mentioned specimens previously identified as *taeniorhynchoides* were incorrect determinations, I am doubtful if this species occurs in Southeast Asia. It probably has a more restricted range in Ceylon, India and Pakistan. Other records for this species from Southeast Asia may possibly be incorrect determinations for *Aedes pipersalatus*, *vexans vexans* or *vigilax*.

The confusion in the identification of *taeniorhynchoides* in the past is probably a result of an inadequate original description without illustrations. Even though it is doubtful that this species occurs in Southeast Asia it is included in this paper (adult key and Figs. 13, 16, 17, 30, 46) in order to clarify identification of closely related species.

The adult habitus and female and male genitalia of *taeniorhynchoides* are similar to *pipersalatus* and are discussed under that species. Females of *taeniorhynchoides* also resemble *vexans vexans* and *Aedes (Ochlerotatus)*

vigilax (Skuse) from which they can be separated by the large number of white scales intermixed with brown ones on most of the dorsal veins of the wing, especially on the radius and among the tertiary fringe scales along the posterior margin of the wing while *vexans vexans* has the distal 0.85 of the radius 2+3 brown scaled. *Aedes vexans vexans* and *vigilax* have all the scales along the posterior margin of the wing brown. *Aedes vigilax* also has the subspiracular area bare while *vexans vexans* and *taeniorhynchoides* both have scales on this area. *Aedes taeniorhynchoides* has the postpronotum completely covered with narrow curved pale scales while *vexans vexans* has the upper portion of this area with reddish-brown scales and white ones below. The aedeagus, proctiger and gonostylus of the male genitalia of *taeniorhynchoides* are markedly different from those of *vexans vexans* (Figs. 33 and 47) and *vigilax* (aedeagus is a simple tube).

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APPENDIX: TABLE 1. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) alboscutellatus*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen II		
1	2-4	3	2.6	0	1	1	1
2	2-4	3	3.1	1	3-7	4	4.7
3	2-4	3	2.8	2	1	1	1
4	3-5	4	4.1	3	1-2	2	1.6
5	4-6	5	5	4	2-5	3	3.5
6	2-3	2	2.3	5	3-6	5	4.6
7	3-4	4	3.8	6	1-3	3	2.6
8	5-9	6	6.3	7	2-3	2	2.1
9	1-3	3	2.3	9	1	1	1
	Metanotum				Abdomen III		
10	3-5	3	3.5	0	1	1	1
11	1	1	1	1	6-10	7	7.7
12	4-7	5	5.4	2	1	1	1
	Abdomen I			3	1	1	1
1	17-22	18	18.6	4	2-4	2	2.7
2	1	1	1	5	3-8	4	5.1
3	1	1	1	6	2-4	3	3.1
4	6-11	8	7.7	7	2-4	2	2.6
5	2-5	2	2.7	8	2-4	4	3.7
6	2-3	2	2.3	9	1	1	1
7	2-3	2	2.4	10	2-4	3	2.8
9	1	1	1	11	1	1	1
				14	1	1	1

TABLE 1. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen IV				Abdomen V (Cont.)		
0	1	1	1	10	2-3	2	2.1
1	3-6	5	4.4	11	1	1	1
2	1	1	1	14	1	1	1
3	3-6	5	4.6		Abdomen VI		
4	2-4	2	2.7	0	1	1	1
5	2	2	2	1	2-4	4	3.4
6	1-3	3	2.2	2	1	1	1
7	2-3	2	2.3	3	2-4	3	2.9
8	2-4	2	2.6	4	3-9	5	4.8
9	1	1	1	5	2-3	2	2.2
10	2-4	3	2.7	6	2-4	3	2.8
11	1	1	1	7	2	2	2
14	1	1	1	8	2-4	3	2.9
	Abdomen V			9	1	1	1
0	1	1	1	10	1	1	1
1	2-5	4	3.7	11	1	1	1
2	1	1	1	14	1	1	1
3	2-5	3	3.1		Abdomen VII		
4	4-9	5	6.1	0	1	1	1
5	2	2	2	1	4-6	4	4.4
6	1-3	2	2.1	2	1	1	1
7	5-9	6	6.3	3	2-6	4	3.7
8	2-3	3	2.6	4	3-5	3	3.7
9	1	1	1	5	3-6	4	3.9

TABLE 1. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen VII (Cont.)				Abdomen VIII		
6	4-10	5	6.4	0	1	1	1
7	1-3	2	2.1	4	2-4	3	3
8	3-4	3	3.2	9	4-7	6	6.2
9	2-5	3	3.1	14	1	1	1
10	2-3	2	2.4		Paddle		
11	2-3	2	2.1	1	2-3	2	2.2
14	1	1	1				

APPENDIX: TABLE 2. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) caecus*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen I		
1	3	3	3	1	18-30	21	24.1
2	2-4	3	2.8	2	1	1	1
3	2-4	3	2.8	3	1	1	1
4	3-6	4	4.1	4	6-10	7	7.3
5	2-5	4	3.6	5	2-5	3	3.6
6	1-3	1	1.5	6	1	1	1
7	2-4	3	3.1	7	2-5	3	2.8
8	5-7	5	5.6	9	1	1	1
9	3-4	3	3.1	10	1	1	1
	Metanotum			11	1-2	1	1.2
10	7-11	9	9		Abdomen II		
11	1	1	1	0	1	1	1
12	5-8	5	5.9	1	20-32	21	25.2

TABLE 2. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen II (Cont.)				Abdomen IV (Cont.)		
2	1	1	1	2	1	1	1
3	1	1	1	3	4-7	5	5.1
4	2-5	4	4.3	4	1-2	2	1.9
5	3-5	4	4.1	5	2-3	2	2.2
6	1-2	1	1.1	6	2-4	3	2.9
7	1-3	2	2.1	7	2-3	2	2.2
9	1	1	1	8	2-3	2	2.3
	Abdomen III			9	1	1	1
0	1	1	1	10	2-4	3	2.7
1	5-8	7	7.1	11	1	1	1
2	1	1	1	14	1	1	1
3	1	1	1		Abdomen V		
4	2-3	3	2.6	0	1	1	1
5	4-6	5	4.7	1	3-6	4	4.1
6	2-4	3	3	2	1	1	1
7	2-5	2	2.7	3	2-3	3	2.7
8	2-4	2	2.5	4	3-7	5	5.1
9	1	1	1	5	2	2	2
10	2-4	3	3	6	2-3	2	2.2
11	1	1	1	7	5-8	5	5.9
14	1	1	1	8	2-3	2	2.1
	Abdomen IV			9	1	1	1
0	1	1	1	10	1	1	1
1	4-6	6	5.2	11	1	1	1

TABLE 2. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen V (Cont.)				Abdomen VII (Cont.)		
14	1	1	1	2	1	1	1
	Abdomen VI			3	3-7	5	4.7
0	1	1	1	4	2-4	3	3.2
1	2-5	4	3.8	5	2-4	2	2.6
2	1	1	1	6	3-7	4	4.7
3	2-3	3	2.6	7	1-2	1	1.2
4	3-6	4	4.3	8	2-4	2	2.8
5	1-3	2	2.1	9	3-7	5	5.1
6	1-2	1	1.2	10	1-3	2	1.9
7	1-2	1	1.1	11	1	1	1
8	1-3	2	2.1	14	1	1	1
9	1	1	1		Abdomen VIII		
10	1	1	1	0	1	1	1
11	1	1	1	4	2-4	3	3.1
14	1	1	1	9	7-11	9	8.6
	Abdomen VII			14	1	1	1
0	1	1	1		Paddle		
1	2-5	3	3.3	1	1	1	1

APPENDIX: TABLE 3. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) culicinus*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen II		
1	3-4	3	3.4	0	1	1	1
2	2-4	3	3.1	1	14-20	14	15.9
3	3-4	3	3.3	2	1	1	1
4	3-4	3	3.4	3	1	1	1
5	4-6	4	4.9	4	4-8	5	5.3
6	2	2	2	5	4-7	5	5.6
7	3-5	4	4.3	6	1-2	2	1.6
8	5-9	7	6.4	7	2-4	3	2.6
9	2-3	3	2.6	9	1	1	1
	Metanotum				Abdomen III		
10	6-9	7	7.1	0	1	1	1
11	1	1	1	1	7-13	8	8.9
12	4-7	4	5.3	2	1	1	1
	Abdomen I			3	1	1	1
1	16-24	21	20	4	3-5	4	3.8
2	1-2	1	1.2	5	4-8	5	5.1
3	1	1	1	6	2-3	3	2.6
4	7-12	11	9.3	7	3-5	3	3.5
5	2-6	4	3.9	8	3-5	4	4.1
6	1-3	2	2.1	9	1	1	1
7	2-4	3	2.7	10	1-4	2	2.3
9	1	1	1	11	1	1	1
				14	1	1	1

TABLE 3. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen IV				Abdomen V (Cont.)		
0	1	1	1	10	1-2	1	1.4
1	4-9	5	5.8	11	1	1	1
2	1	1	1	14	1	1	1
3	4-7	6	5.5		Abdomen VI		
4	2-3	2	2.4	0	1	1	1
5	2	2	2	1	3-7	5	5.4
6	2-3	2	2.3	2	1	1	1
7	2-4	3	3.2	3	2-4	3	3.2
8	2-5	3	3.1	4	3-8	4	5.2
9	1	1	1	5	2-3	3	2.6
10	1-3	3	2.4	6	2-3	3	2.7
11	1	1	1	7	2	2	2
14	1	1	1	8	3-4	4	3.6
	Abdomen V			9	1	1	1
0	1	1	1	10	1	1	1
1	4-9	5	5.4	11	1	1	1
2	1	1	1	14	1	1	1
3	2-4	3	2.9		Abdomen VII		
4	4-7	6	5.8	0	1	1	1
5	2-3	2	2.1	1	5-8	6	5.9
6	1-3	2	2.1	2	1	1	1
7	4-8	6	6.2	3	4-7	5	5.4
8	2-4	3	3.1	4	3-6	4	3.9
9	1	1	1	5	4-8	7	6.3

TABLE 3. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen VII (Cont.)				Abdomen VIII		
6	6-9	7	7.6	0	1	1	1
7	2-4	3	2.6	4	3-5	4	3.9
8	2-6	3	3.5	9	7-11	9	8.6
9	4-5	4	4.4	14	1	1	1
10	2-3	2	2.2		Paddle		
11	2	2	2	1	1-2	1	1.4
14	1	1	1				

APPENDIX: TABLE 4. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) mediolineatus*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen I		
1	3-5	4	3.6	1	17-30	22	24.6
2	3-4	4	3.6	2	1	1	1
3	2-4	3	2.9	3	1	1	1
4	2-4	3	3.3	4	8-17	12	13.9
5	3-5	4	3.8	5	3-6	4	4.2
6	2-4	3	3.1	6	1-2	1	1.1
7	2-5	4	3.6	7	2-3	2	2.4
8	2-6	3	3.6	9	1	1	1
9	2	2	2		Abdomen II		
	Metanotum			0	1	1	1
10	11-24	12	13.8	1	17-28	22	22.8
11	1	1	1	2	1-2	1	1.1
12	4-5	4	4.4	3	1-2	1	1.3

TABLE 4. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen II (Cont.)				Abdomen IV (Cont.)		
4	6-10	7	7.6	4	2-6	4	3.9
5	4-8	6	5.5	5	2-4	3	2.6
6	1	1	1	6	2-4	2	2.6
7	1-4	2	2.6	7	2-4	3	2.7
9	1	1	1	8	2-4	2	2.6
	Abdomen III			9	1	1	1
0	1	1	1	10	2-3	2	2.1
1	7-18	15	12.2	11	1	1	1
2	1	1	1	14	1	1	1
3	1	1	1		Abdomen V		
4	2-8	4	3.9	0	1	1	1
5	4-9	5	5.6	1	3-6	5	4.5
6	2-4	2	2.3	2	1	1	1
7	2-5	3	3.4	3	2-3	2	2.4
8	3-6	4	4.4	4	7-11	9	8.3
9	1	1	1	5	2-3	2	2.5
10	2-4	3	2.7	6	2-3	2	2.3
11	1	1	1	7	5-10	7	7.2
14	1	1	1	8	2-5	3	3.3
	Abdomen IV			9	1	1	1
0	1	1	1	10	1	1	1
1	3-7	5	5.1	11	1	1	1
2	1	1	1	14	1	1	1
3	5-12	6	7.6				

TABLE 4. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen VI				Abdomen VII (Cont.)		
0	1	1	1	3	3-7	5	5.1
1	4-5	5	4.6	4	2-5	3	3.2
2	1	1	1	5	3-6	5	4.6
3	2-3	2	2.3	6	8-12	11	10.5
4	4-8	5	5.1	7	2-3	3	2.6
5	2-5	4	3.2	8	3-7	5	5.6
6	2-4	3	2.7	9	5-11	5	6.8
7	1-2	1	1.2	10	1-3	2	2.3
8	3-5	4	3.8	11	1-3	2	1.8
9	1	1	1	14	1	1	1
10	1	1	1		Abdomen VIII		
11	1	1	1	0	1	1	1
14	1	1	1	4	2-4	3	2.9
	Abdomen VII			9	7-14	8	8.9
0	1	1	1	14	1	1	1
1	3-6	4	4.4		Paddle		
2	1	1	1	1	1-2	2	1.9

APPENDIX: TABLE 5. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) orbitae*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen II		
1	3-6	5	4.5	0	1	1	1
2	3-4	3	3.3	1	33-65	38	41.5
3	2-3	3	2.6	2	1	1	1
4	3-6	4	4.3	3	1	1	1
5	3-6	4	3.9	4	3-6	5	4.8
6	2-3	2	2.1	5	3-5	4	4.2
7	3-5	4	3.7	6	1-3	2	1.8
8	7-9	7	7.5	7	2-6	4	4.2
9	2-4	3	2.9	9	1	1	1
	Metanotum				Abdomen III		
10	17-33	18	22.3	0	1	1	1
11	1	1	1	1	8-17	12	11.5
12	5-10	5	6.1	2	1	1	1
	Abdomen I			3	1	1	1
1	16-24	21	21.1	4	2-5	4	3.6
2	1	1	1	5	3-5	4	3.9
3	1	1	1	6	1-4	4	2.8
4	7-16	10	10.1	7	2-5	4	3.7
5	3-7	4	4.4	8	2-5	4	3.8
6	2-3	2	2.4	9	1	1	1
7	3-6	4	4.3	10	4-6	4	4.3
9	1	1	1	11	1	1	1
				14	1	1	1

TABLE 5. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen IV				Abdomen V (Cont.)		
0	1	1	1	11	1	1	1
1	5-11	10	8.6	14	1	1	1
2	1	1	1		Abdomen VI		
3	4-7	4	5.3	0	1	1	1
4	1-2	2	1.6	1	4-7	5	5.1
5	2	2	2	2	1	1	1
6	1-3	2	2.4	3	2-4	3	3.2
7	1-3	2	1.9	4	4-6	5	4.8
8	2-4	3	2.9	5	1-2	2	1.8
9	1	1	1	6	1	1	1
10	3-5	4	3.9	7	1-3	2	1.9
11	1	1	1	8	2-4	2	2.2
14	1	1	1	9	1	1	1
	Abdomen V			10	1	1	1
0	1	1	1	11	1	1	1
1	5-10	6	6.5	14	1	1	1
2	1	1	1		Abdomen VII		
3	2-3	3	2.7	0	1	1	1
4	5-11	8	7.3	1	3-6	4	4.1
5	2	2	2	2	1	1	1
6	1-3	2	1.8	3	4-6	5	4.9
7	5-8	7	6.8	4	2-4	3	2.7
8	2-4	2	3.3	5	2-4	2	2.7
9	1	1	1	6	6-11	7	8.1
10	1	1	1				

TABLE 5. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen VII				Abdomen VIII		
7	1-3	2	1.9	0	1	1	1
8	3-5	3	3.6	4	2-3	3	2.7
9	4-6	5	5.2	9	8-13	9	10.2
10	2-3	2	2.4	14	1	1	1
11	1	1	1		Paddle		
14	1	1	1	1	1	1	1

APPENDIX: TABLE 6. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) pallidostriatus*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen I		
1	2-4	3	3	1	30-46	35	37.7
2	2-3	3	2.8	2	1	1	1
3	3-4	3	3.3	3	1-2	1	1.2
4	3-5	3	3.6	4	8-15	10	10.4
5	3-6	4	4.4	5	4-7	5	5
6	2-4	2	2.4	6	1-2	1	1.4
7	2-3	3	2.9	7	2-4	3	3.1
8	2-6	3	4.8	9	1	1	1
9	2-3	2	2.3	10	1	1	1
	Metanotum			11	1	1	1
10	10-18	12	13.3		Abdomen II		
11	1	1	1	0	1	1	1
12	3-7	4	4.7	1	9-36	21	22.1

TABLE 6. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen II (Cont.)				Abdomen IV (Cont.)		
2	1	1	1	2	1	1	1
3	2-3	3	2.6	3	4-10	7	6.9
4	5-9	7	7	4	2-5	3	3
5	2-9	6	4.9	5	2-3	3	2.9
6	1-3	2	1.9	6	2-6	3	3.6
7	3-4	4	3.6	7	3-6	4	4.1
9	1	1	1	8	3-4	3	3.1
	Abdomen III			9	1	1	1
0	1	1	1	10	2-4	3	2.9
1	7-18	18	13.4	11	1	1	1
2	1	1	1	14	1	1	1
3	1	1	1		Abdomen V		
4	3-5	5	4.4	0	1	1	1
5	3-11	8	7.1	1	4-6	6	5.4
6	2-4	3	2.8	2	1	1	1
7	4-7	5	5.4	3	2-3	3	2.6
8	3-7	4	4.8	4	5-9	8	7.3
9	1	1	1	5	3-4	3	3.1
10	2-3	2	2.3	6	2-3	3	2.6
11	1	1	1	7	8-11	8	8.7
14	1	1	1	8	3-5	4	4
	Abdomen IV			9	1	1	1
0	1	1	1	10	1-3	1	1.3
1	5-13	7	7.7	11	1	1	1

TABLE 6. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen V (Cont.)				Abdomen VII (Cont.)		
14	1	1	1	2	1	1	1
	Abdomen VI			3	4-9	7	7.8
0	1	1	1	4	2-4	4	3.4
1	4-9	5	6.4	5	4-9	7	6.7
2	1	1	1	6	8-13	10	10.6
3	2-4	3	3.2	7	1-4	3	2.4
4	3-7	6	5.6	8	3-7	3	4
5	3-4	3	3.4	9	3-8	6	5.9
6	2-3	3	2.5	10	1-3	2	1.9
7	2-3	2	2.1	11	1-3	1	1.5
8	3-4	4	3.6	14	1	1	1
9	1	1	1		Abdomen VIII		
10	1-2	1	1.1	0	1	1	1
11	1-2	1	1.1	4	2-3	3	2.8
14	1	1	1	9	7-13	9	9.8
	Abdomen VII			14	1	1	1
0	1	1	1		Paddle		
1	5-9	7	6.5	1	1	1	1

APPENDIX: TABLE 7. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) pampangensis*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen II		
1	5-8	5	6	0	1	1	1
2	4-8	5	5.6	1	24-40	36	33.6
3	3-5	5	4.3	2	1	1	1
4	6-8	7	6.9	3	1-2	2	1.6
5	6-9	6	7.5	4	6-11	6	7.8
6	2-4	3	3	5	10-14	10	11.4
7	8-11	9	8.9	6	2-5	3	3.2
8	7-12	12	10.5	7	6-10	6	7
9	2-4	3	2.9	9	1	1	1
	Metanotum			14	1	1	1
10	13-16	13	14.3		Abdomen III		
11	1	1	1	0	1	1	1
12	3-11	6	6.6	1	10-16	12	12.4
	Abdomen I			2	1	1	1
1	21-42	35	32.3	3	1	1	1
2	1	1	1	4	4-8	4	5.3
3	1	1	1	5	9-13	11	10.8
4	10-18	15	14.6	6	4-8	6	6.1
5	5-7	6	4.9	7	4-6	5	4.9
6	2-3	2	2.2	8	4-7	6	5.9
7	4-6	5	4.8	9	1	1	1
9	1	1	1	10	2-5	2	3.1

TABLE 7. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen III (Cont.)				Abdomen V (Cont.)		
11	1	1	1	7	7-11	9	8.9
14	1	1	1	8	3-4	3	3.4
	Abdomen IV			9	1	1	1
0	1	1	1	10	2-4	3	3
1	5-11	7	7.6	11	1	1	1
2	1	1	1	14	1	1	1
3	5-9	8	7.4		Abdomen VI		
4	3-6	3	4.1	0	1	1	1
5	2-5	3	3.1	1	7-13	9	9.5
6	5-8	6	6.6	2	1	1	1
7	4-6	4	4.4	3	4-8	4	5.4
8	3-4	3	3.4	4	7-11	8	9.9
9	1	1	1	5	3-6	5	4.4
10	3-5	4	4.3	6	6-8	8	7.3
11	1	1	1	7	2-4	3	2.8
14	1	1	1	8	4-6	4	4.8
	Abdomen V			9	1	1	1
0	1	1	1	10	1-3	2	2
1	5-9	8	8.6	11	1	1	1
2	1	1	1	14	1	1	1
3	3-5	4	4		Abdomen VII		
4	9-14	12	11.6	0	1	1	1
5	3-5	3	3.8	1	7-10	7	8.1
6	5-8	5	5.9	2	1	1	1

TABLE 7. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen VII (Cont.)				Abdomen VII (Cont.)		
3	9-16	11	12.1	11	2-4	3	2.8
4	4-10	6	7.1	14	1	1	1
5	5-9	7	7.3		Abdomen VIII		
6	7-14	10	10.1	0	1	1	1
7	2-5	4	4.1	4	5-8	7	6.4
8	3-7	5	5.3	9	11-14	14	12.9
9	5-7	6	6.1	14	1	1	1
10	2-5	4	3.6		Paddle		
				1	1-2	2	1.8

APPENDIX: TABLE 8. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) pipersalatus*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Metanotum		
1	2-3	3	2.6	10	5-9	6	6.2
2	2-4	3	2.9	11	1	1	1
3	2-4	2	2.6	12	4-7	4	5
4	3-4	3	3.3		Abdomen I		
5	3-5	4	4.3	1	21-38	31	29.1
6	2-4	3	2.9	2	1	1	1
7	3-6	4	4.2	3	1	1	1
8	2-7	5	4.6	4	7-16	9	10.9
9	2-4	2	2.6	5	3-6	6	5.2

TABLE 8. (Continued)

Hair	Range	Mode	Mean
	Abdomen I (Cont.)		
6	1-3	1	1.5
7	3-5	3	3.4
9	1	1	1
	Abdomen II		
0	1	1	1
1	13-20	18	17.4
2	1	1	1
3	1	1	1
4	7-16	8	9.4
5	4-7	5	4.9
6	1-3	3	2.2
7	2-4	3	3.1
9	1	1	1
14	1	1	1
	Abdomen III		
0	1	1	1
1	5-10	7	7.8
2	1	1	1
3	1	1	1
4	3-6	5	4.6
5	3-7	4	4.8
6	2-4	2	2.6
7	3-9	4	4.9
8	3-5	3	3.5
9	1	1	1
	Abdomen III (Cont.)		
10	2-4	3	2.8
11	1	1	1
14	1	1	1
	Abdomen IV		
0	1	1	1
1	3-6	6	4.9
2	1	1	1
3	5-7	5	5.3
4	2-5	3	3.7
5	2	2	2
6	1-4	2	2.5
7	3-5	3	3.3
8	2-3	2	2.4
9	1	1	1
10	2-4	2	2.4
11	1	1	1
14	1	1	1
	Abdomen V		
0	1	1	1
1	3-5	4	3.8
2	1	1	1
3	2-3	2	2.1
4	4-8	5	5.3
5	2-3	2	2.3

TABLE 8. (Continued)

Hair	Range	Mode	Mean
	Abdomen V (Cont.)		
6	2-4	3	2.7
7	5-8	7	6.7
8	2-3	3	2.8
9	1	1	1
10	1-2	1	1.1
11	1	1	1
14	1	1	1
	Abdomen VI		
0	1	1	1
1	3-7	5	4.4
2	1	1	1
3	2-3	2	2.2
4	3-6	5	4.7
5	2-5	3	2.7
6	2-3	2	2.4
7	2	2	2
8	2-4	3	2.9
9	1	1	1
10	1-2	1	1.2
11	1	1	1
14	1	1	1
	Abdomen VII		
0	1	1	1
1	3-6	4	4.3
2	1	1	1
3	3-9	5	5.3
4	2-4	3	2.8
5	3-6	4	4.2
6	6-14	8	9.1
7	2-3	2	2.1
8	2-5	3	3.6
9	3-6	4	4.3
10	1-2	2	1.8
11	1-2	2	1.6
14	1	1	1
	Abdomen VIII		
0	1	1	1
4	3-4	3	3.1
9	7-10	7	7.1
14	1	1	1
	Paddle		
1	1	1	1

APPENDIX: TABLE 9. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) vexans vexans*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Abdomen II		
1	2-3	2	2.3	0	1	1	1
2	2-3	2	2.1	1	5-14	10	9.4
3	2	2	2	2	1	1	1
4	1-4	2	2.5	3	1-2	2	1.7
5	1-3	2	2.4	4	2-4	3	2.7
6	1-4	1	1.7	5	2-5	4	3.3
7	2-5	3	3.2	6	1-3	1	1.2
8	2-4	4	3.4	7	1-3	1	1.4
9	1-2	2	1.8	9	1	1	1
	Metanotum				Abdomen III		
10	4-11	7	7	0	1	1	1
11	1	1	1	1	3-5	4	3.9
12	1-3	1	1.7	2	1	1	1
	Abdomen I			3	1-2	1	1.2
1	17-25	21	21	4	1-4	3	2.5
2	1	1	1	5	2-6	4	3.8
3	1	1	1	6	1-3	1	1.5
4	2-8	3	3.9	7	2-4	3	2.9
5	2-4	2	2.8	8	1-4	2	2.1
6	1-2	1	1.1	9	1	1	1
7	1-3	1	1.2	10	1-3	1	1.8
9	1	1	1	11	1	1	1
10	1	1	1	14	1	1	1

TABLE 9. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen IV				Abdomen V (Cont.)		
0	1	1	1	10	1	1	1
1	2-5	3	3	11	1	1	1
2	1	1	1	14	1	1	1
3	2-7	5	4.2		Abdomen VI		
4	1-5	1	1.9	0	1	1	1
5	1-3	2	2.1	1	1-3	2	1.8
6	1-3	1	1.6	2	1	1	1
7	2-4	2	2.4	3	1-4	1	1.4
8	1-3	1	1.7	4	1-4	2	2.2
9	1	1	1	5	1-2	2	1.9
10	1-2	1	1.4	6	1-2	1	1.4
11	1	1	1	7	1-2	1	1.1
14	1	1	1	8	1-2	2	1.6
	Abdomen V			9	1	1	1
0	1	1	1	10	1	1	1
1	1-3	2	2.1	11	1	1	1
2	1	1	1	14	1	1	1
3	1-4	2	1.9		Abdomen VII		
4	1-5	3	2.9	0	1	1	1
5	1-2	2	1.8	1	1-3	1	1.6
6	1-2	1	1.2	2	1	1	1
7	1-5	2	2.9	3	2-5	3	2.9
8	1-3	1	1.3	4	1-3	2	2.8
9	1	1	1	5	1-3	1	1.6

TABLE 9. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen VII (Cont.)				Abdomen VIII		
6	2-5	3	3.5	0	1	1	1
7	1	1	1	4	1-2	2	1.7
8	1-4	2	2.1	9	4-7	5	5.3
9	2-4	3	3.3	14	1	1	1
10	1	1	1		Paddle		
11	1	1	1	1	1	1	1
14	1	1	1				

APPENDIX: TABLE 10. Record of the branching of the setae on the pupae of *Aedes (Aedimorphus) vexans nipponii*

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Cephalothorax				Metanotum (Cont.)		
1	2-3	3	2.6	12	1-4	2	1.6
2	2-3	2	2.1		Abdomen I		
3	2-4	2	2.3	1	16-22	18	18.4
4	2-3	3	2.9	2	1	1	1
5	2-4	3	2.8	3	1	1	1
6	1-4	3	2.4	4	2-5	3	3.3
7	2-4	4	3.4	5	1-3	3	2.7
8	3-6	5	4.5	6	1-2	1	1.4
9	1-2	1	1.4	7	2-4	3	2.9
	Metanotum			9	1	1	1
10	4-10	5	5.8	10	1	1	1
11	1	1	1				

TABLE 10. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen II				Abdomen IV		
0	1	1	1	0	1	1	1
1	4-10	6	7.2	1	2-5	3	3.2
2	1	1	1	2	1	1	1
3	1-2	1	1.1	3	3-6	5	4.7
4	2-4	3	2.8	4	1-4	2	2.1
5	2-5	3	2.9	5	2-3	2	2.1
6	1-2	1	1.3	6	1-3	2	1.8
7	2-5	2	2.6	7	1-4	2	1.8
9	1	1	1	8	1-3	2	2
	Abdomen III			9	1	1	1
0	1	1	1	10	1-3	2	2
1	3-6	4	4.3	11	1	1	1
2	1	1	1	14	1	1	1
3	1-2	1	1.1		Abdomen V		
4	2-5	3	2.9	0	1	1	1
5	2-7	4	4.2	1	2-4	3	3
6	1-3	1	1.9	2	1	1	1
7	2-4	3	2.7	3	2-4	2	2.6
8	1-5	3	2.8	4	1-5	3	2.8
9	1	1	1	5	2-3	2	2.1
10	1-3	2	1.8	6	1-2	2	1.7
11	1	1	1	7	1-5	2	2.3
14	1	1	1	8	1-3	2	1.9

TABLE 10. (Continued)

Hair	Range	Mode	Mean	Hair	Range	Mode	Mean
	Abdomen V (Cont.)				Abdomen VII (Cont.)		
9	1	1	1	1	1-3	2	1.9
10	1	1	1	2	1	1	1
11	1	1	1	3	2-7	3	3.3
14	1	1	1	4	1-3	2	1.8
	Abdomen VI			5	2-3	2	2.2
0	1	1	1	6	3-5	4	3.6
1	2-5	3	2.8	7	1-2	1	1.1
2	1	1	1	8	2-5	3	2.7
3	1-3	1	1.3	9	2-4	3	3
4	2-4	3	3	10	1	1	1
5	2	2	2	11	1-2	1	1.1
6	1-2	2	1.8	14	1	1	1
7	1-2	1	1.1		Abdomen VIII		
8	2-4	2	2.2	0	1	1	1
9	1	1	1	4	1-4	2	2.2
10	1	1	1	9	4-7	5	5.4
11	1	1	1	14	1	1	1
14	1	1	1		Paddle		
	Abdomen VII			1	1-2	1	1.2
0	1	1	1				

APPENDIX: TABLE 11. Species of *Aedes (Aedimorphus)* occurring in the Oriental Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
alboscutellatus	X**	X**	X**	X**	-
argenteoscutellatus	-	X*	-	-	-
caecus	X**	X**	X**	X**	-
culicinus	X**	X**	X**	X**	-
davidi	-	X*	-	-	-
gouldi	X*	-	-	-	-
jamesi	X	X*	-	X*	-
lowisii	X**	X**	-	-	-
mediolineatus	X**	X**	X**	X**	X**
nigrostriatus	X**	X**	-	-	-
orbitae	X**	X**	X**	X**	-
pallidostriatus	X**	X**	X**	X**	-
pampangensis	X**	X**	X**	X**	-
pipersalatus	X**	X**	X**	X**	-
punctifemoris	X**	X**	-	-	-
stenoetrus	X**	X**	-	-	-
syntheticus	X	X*	-	X*	-
taeniorhynchoides	X**	X**	-	-	-
trimaculatus	X*	X*	-	-	-
vexans vexans	X**	X**	X**	X**	X*
wainwrighti	X	-	-	-	-

X = Indicates stage has been described in this paper or in the literature.
* = Indicates a portion of the stage has been figured in the literature.
** = Indicates a portion of the stage is figured in this paper.
- = Indicates no description or figure.

APPENDIX: TABLE 12: Species of *Aedes (Aedimorphus)* occurring in the Australian Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
alboscutellatus	X**	X**	X**	X**	-
caecus	X**	X**	X**	X**	-
lowisii	X**	X**	-	-	-
vexans vexans	X**	X**	X**	X**	X*

APPENDIX: TABLE 13. Species of *Aedes (Aedimorphus)* occurring in the Palearctic Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
alboscutellatus	X**	X**	X**	X**	-
vexans vexans	X**	X**	X**	X**	X*
vexans nipponii	X**	X**	X**	X**	-

APPENDIX: TABLE 14. Species of *Aedes (Aedimorphus)* occurring in the Pacific Ocean Islands Region

Species	Female	Male	Pupa	Larva	Egg
alboscutellatus	X**	X**	X**	X**	-
caecus	X**	X**	X**	X**	-
oakleyi	X*	X*	X*	X*	-
senyavinensis	X	X*	X*	X*	-
trukensis	X	-	-	-	-
vexans vexans	X**	X**	X**	X**	X*

X = Indicates stage has been described in this paper or in the literature.
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** = Indicates a portion of the stage is figured in this paper.
\- = Indicates no description or figure.

APPENDIX: TABLE 15. Species of *Aedes (Aedimorphus)* occurring in the Nearctic Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
vexans vexans	X**	X**	X**	X**	X*

APPENDIX: TABLE 16. Species of *Aedes (Aedimorphus)* occurring in the Ethiopian Zoogeographical Region

Species	Female	Male	Pupa	Larva	Egg
abnormalis	-	X*	-	-	-
abnormalis kabwachensis	X	X*	X	X	-
adami	-	X*	-	-	-
albocephalus	X*	X*	X*	X*	-
alboventralis	X*	-	-	-	-
apicoannulatus	X	X	-	-	-
argenteopunctatus	X*	X*	-	X*	-
bedfordi	X	X*	-	-	-
bevisi	X	X*	X	X*	-
boneti	-	X*	-	-	-
boneti kumbae	-	X*	X	X*	-
caliginosus	X	X*	-	-	-
capensis	X*	X*	-	X*	-
centropunctatus	X	X*	X*	X*	-
congolensis	X	X*	-	-	-
chamboni	X*	X*	-	-	-
cumminsii	X*	X*	X	X*	-

X = Indicates stage has been described in this paper or in the literature.
* = Indicates a portion of the stage has been figured in the literature.
** = Indicates a portion of the stage is figured in this paper.
\- = Indicates no description or figure.

TABLE 16. (Continued)

Species	Female	Male	Pupa	Larva	Egg
dalzieli	X*	X*	-	X	-
dentatus	X*	X*	-	X*	-
dialloi	-	X*	-	-	-
domesticus	X	X*	X	X*	X*
durbanensis	X*	X*	X*	X*	-
ebogoensis	-	X*	-	-	-
eritreae	X	X*	-	-	-
eritreae karooensis	X	X*	-	X*	-
falabreguesi	-	X*	-	-	-
filicis	X*	X*	X*	X*	-
fowleri	X*	X*	X	X*	-
gibbinsi	X	X*	X*	X	-
gilliesi	X	X	-	-	-
grenieri	-	X*	-	-	-
grjebinei	-	X	-	-	-
hamoni	X*	X*	-	-	-
haworthi	X*	X*	X	X*	-
hirsutus	X	X*	X*	X*	-
holocinctus	-	X	X*	X*	-
hopkinsi	X	X*	X	X*	-
insolens	X	-	-	-	-
irritans	X*	X*	X*	X*	-
kapretwae	X	X	-	X*	-
kennethi	X	X	-	X*	-
lamborni	X	X*	X	X*	-

TABLE 16. (Continued)

Species	Female	Male	Pupa	Larva	Egg
leesoni	-	X*	-	-	-
leesoni verna	X	X*	X	X*	-
leptolabis	-	X*	X*	X	-
leucarthrius	X	-	-	-	-
lokojoensis	-	X*	X	X	-
longiseta	-	X*	-	-	-
lottei	-	X*	-	-	-
mansouri	X	X*	-	-	-
marshallii	X*	X*	X*	X*	-
mattinglyi	X	X*	X*	X*	-
microstictus	-	X*	-	-	-
minutus	X*	X*	-	X	-
mixtus	-	X*	-	X	-
mutilus	X	X*	X*	X	-
natronius	X	X*	-	X*	-
neobiannulatus	X	-	-	-	-
ngong	X	X	X	X	-
nigricephalus	X*	X*	X*	X*	-
nyounae	-	X*	X*	X*	-
ochraceus	X*	X*	-	X*	-
ovazzai	-	X*	-	-	-
pachyurus	X	X*	-	X	-
phyllolabis	X	X*	X*	X*	-
pseudotarsalis	X	X*	X*	X*	-
pubescens	X	X*	-	-	-

TABLE 16. (Continued)

Species	Female	Male	Pupa	Larva	Egg
punctothoracis	X*	X*	-	-	-
quasiunivittatus	X*	X*	-	X*	-
reali	-	X*	-	-	-
rickenbachi	-	X*	X*	X*	-
semlikiensis	X*	X*	-	-	-
seychellensis	X*	-	-	-	-
simulans	X*	X*	X	X*	-
smithburni	X	X*	-	-	-
stokesi	X	X*	X	X*	-
subdentatus	X	X*	-	-	-
tarsalis	X*	X*	X	X*	-
taufflebi	-	X*	-	-	-
teesdalei	X	X	X*	X	-
tiptoni	-	-	-	X*	-
tricholabis	X	X*	-	-	-
tricholabis bwamba	-	X	X*	X*	-
vexans vexans	X**	X**	X**	X**	X*
wendyae	X	X*	X	X*	-
wigglesworthi	X	X*	X*	X*	-
yangambiensis	-	X*	X*	X*	-
yvonneae	-	X*	-	-	-

X = Indicates stage has been described in this paper or in the literature.
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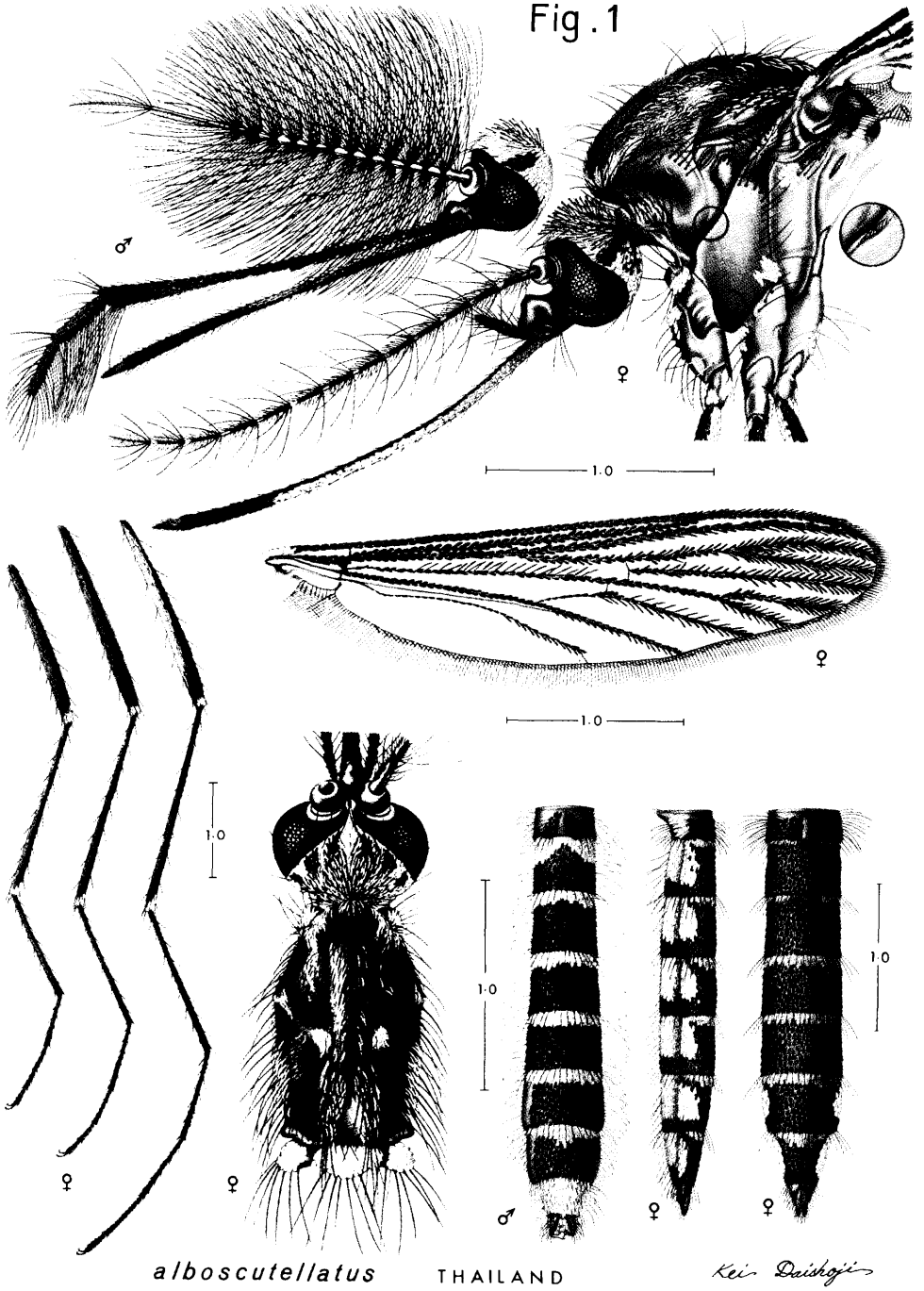
** = Indicates a portion of the stage is figured in this paper.
\- = Indicates no description or figure.

FIGURES

40. *Aedes (Aedimorphus) orbitae* male genitalia
41. *Aedes (Aedimorphus) pallidostriatus* male genitalia
42. *Aedes (Aedimorphus) pampangensis* male genitalia
43. *Aedes (Aedimorphus) pipersalatus* male genitalia
44. *Aedes (Aedimorphus) punctifemoris* male genitalia
45. *Aedes (Aedimorphus) stenoetrus* male genitalia
46. *Aedes (Aedimorphus) taeniorhynchoides* male genitalia
47. *Aedes (Aedimorphus) vexans vexans* male genitalia
48. *Aedes (Aedimorphus) vexans nipponii* male genitalia
49. *Aedes (Aedimorphus) alboscutellatus* pupa
50. *Aedes (Aedimorphus) caecus* pupa
51. *Aedes (Aedimorphus) culicinus* pupa
52. *Aedes (Aedimorphus) mediolineatus* pupa
53. *Aedes (Aedimorphus) orbitae* pupa
54. *Aedes (Aedimorphus) pallidostriatus* pupa
55. *Aedes (Aedimorphus) pampangensis* pupa
56. *Aedes (Aedimorphus) pipersalatus* pupa
57. *Aedes (Aedimorphus) vexans vexans* pupa
58. *Aedes (Aedimorphus) vexans nipponii* pupa
59. *Aedes (Aedimorphus) alboscutellatus* larva
60. *Aedes (Aedimorphus) caecus* larva
61. *Aedes (Aedimorphus) caecus* variations in patches of spicules on larval siphon
62. *Aedes (Aedimorphus) culicinus* larva
63. *Aedes (Aedimorphus) mediolineatus* larva
64. *Aedes (Aedimorphus) orbitae* larva
65. *Aedes (Aedimorphus) pallidostriatus* larva
66. *Aedes (Aedimorphus) pampangensis* larva
67. *Aedes (Aedimorphus) pipersalatus* larva
68. *Aedes (Aedimorphus) vexans vexans* larva
69. *Aedes (Aedimorphus) vexans nipponii* larva
70. Morphology of female genitalia

Fig. 1



alboscutellatus THAILAND

Kei Daishoji

Fig. 2

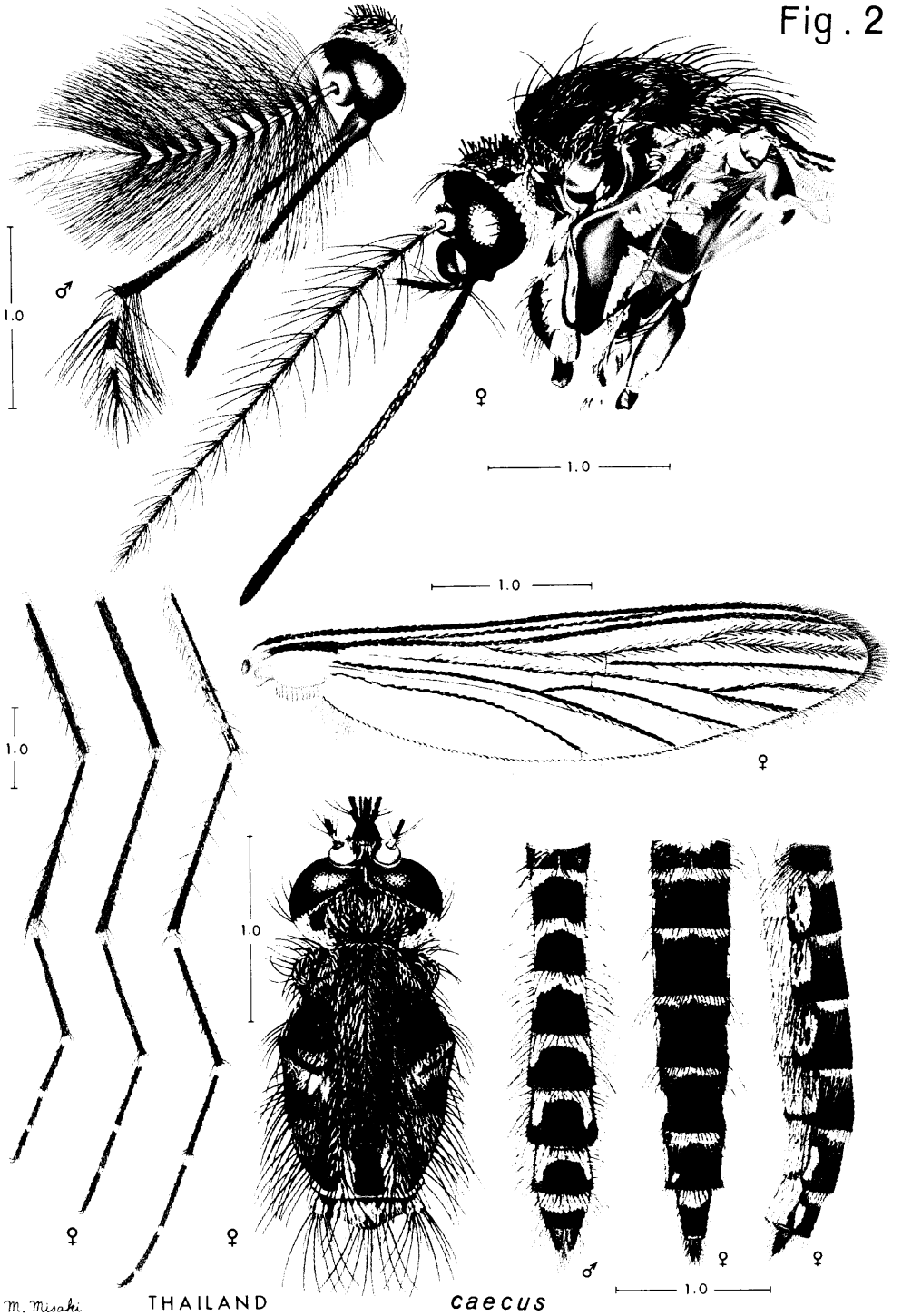
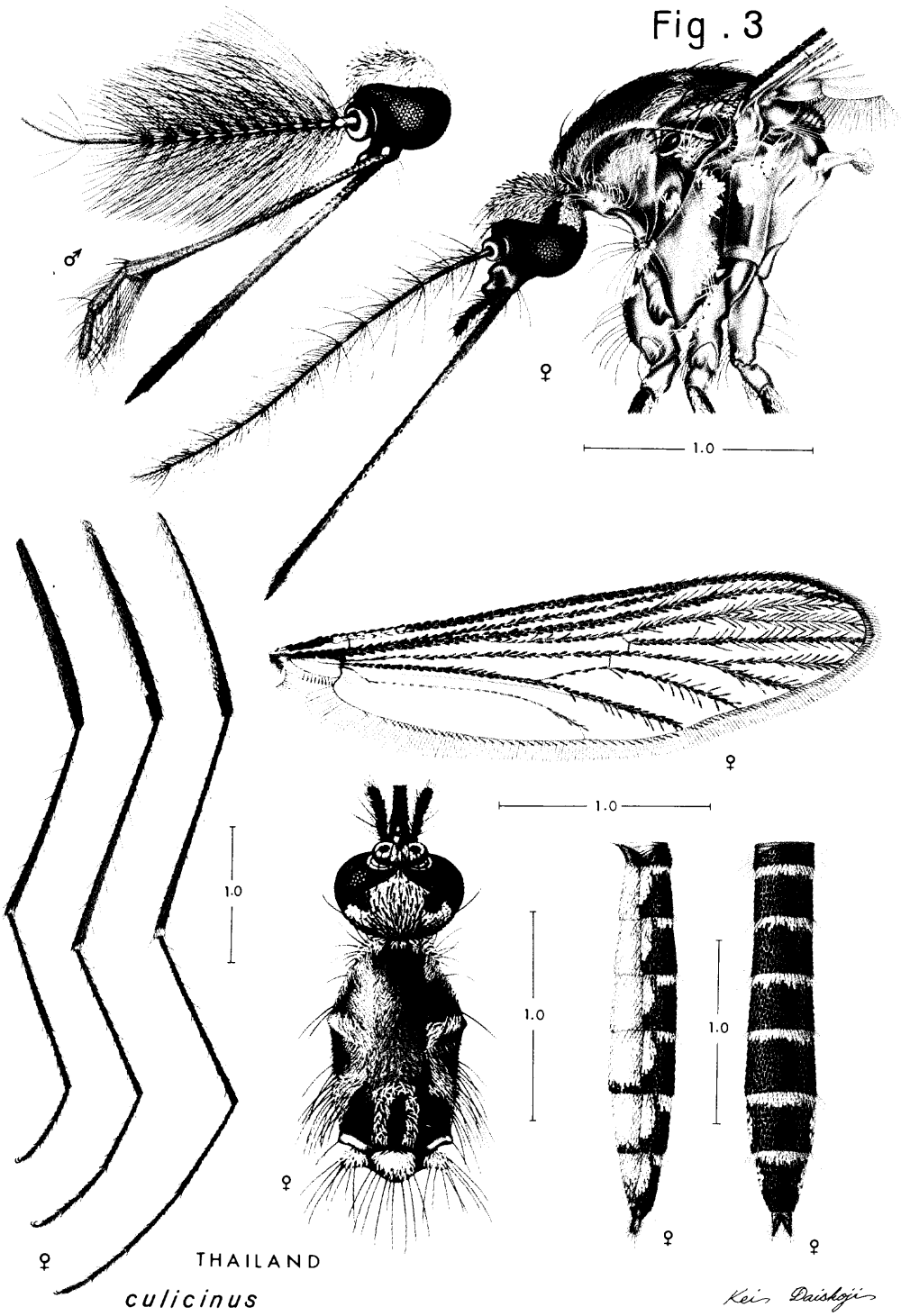


Fig . 3

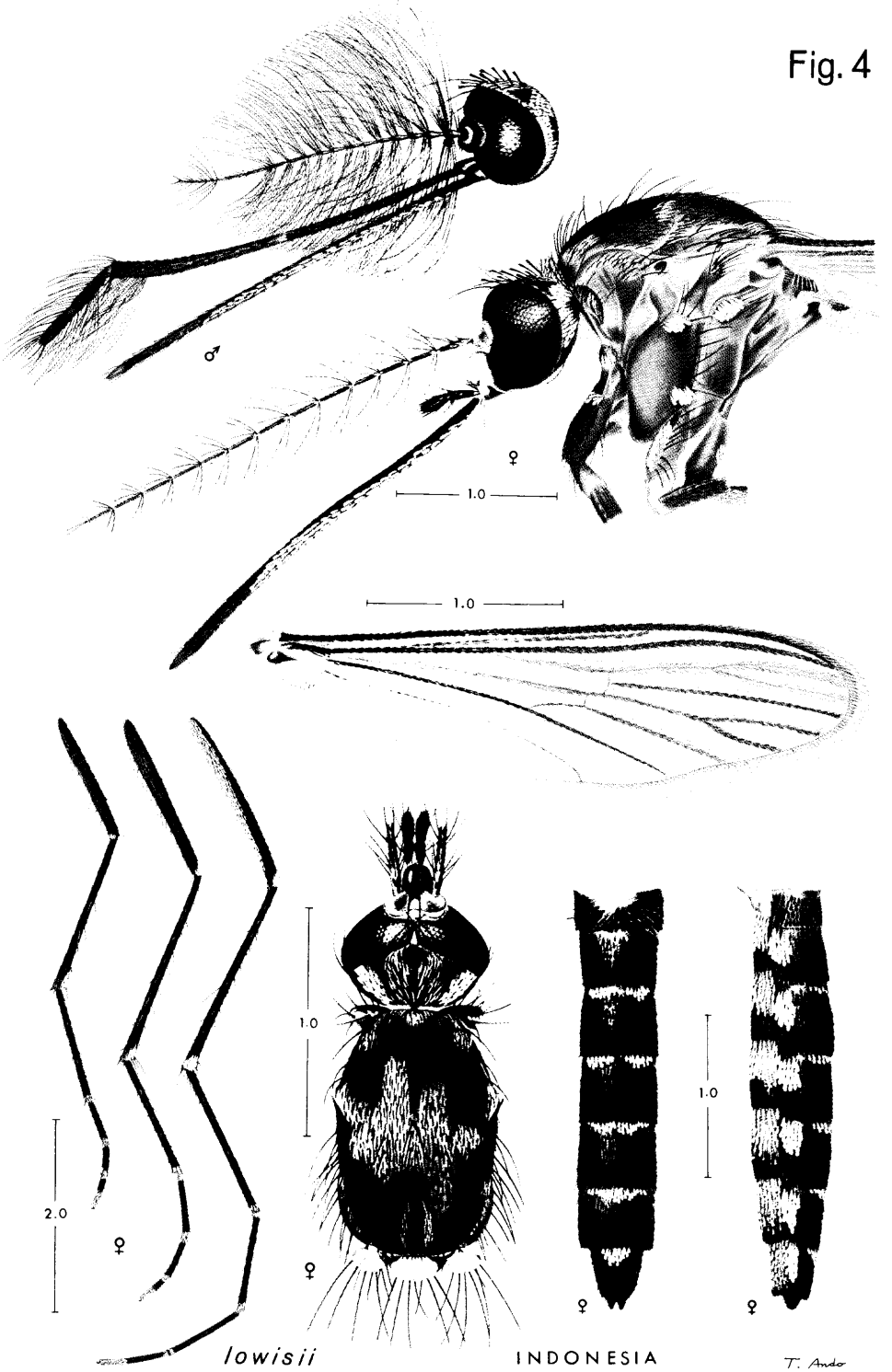


THAILAND

culicinus

Kei Daishoji

Fig. 4



lowisii INDONESIA T. Ando

Fig . 5

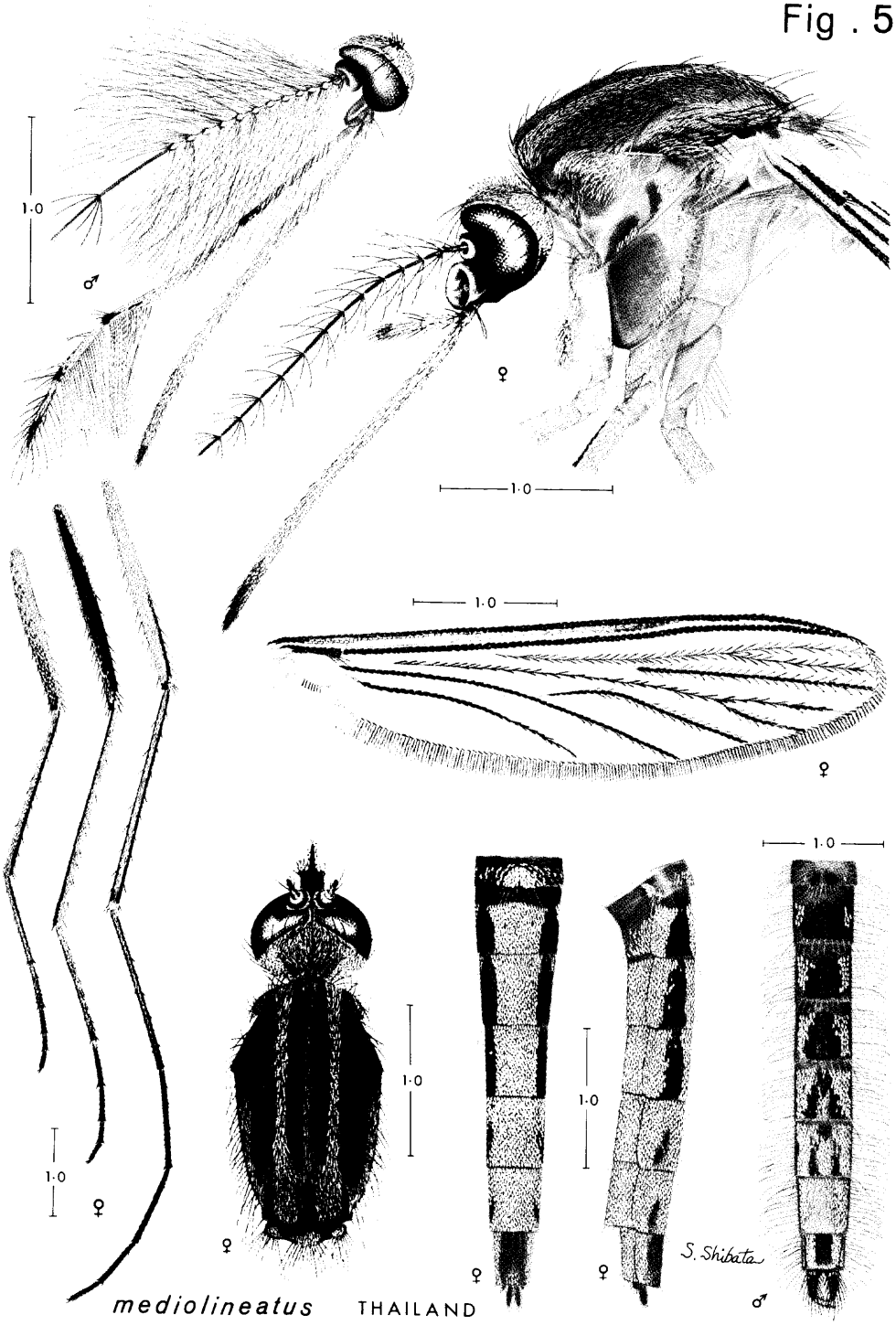
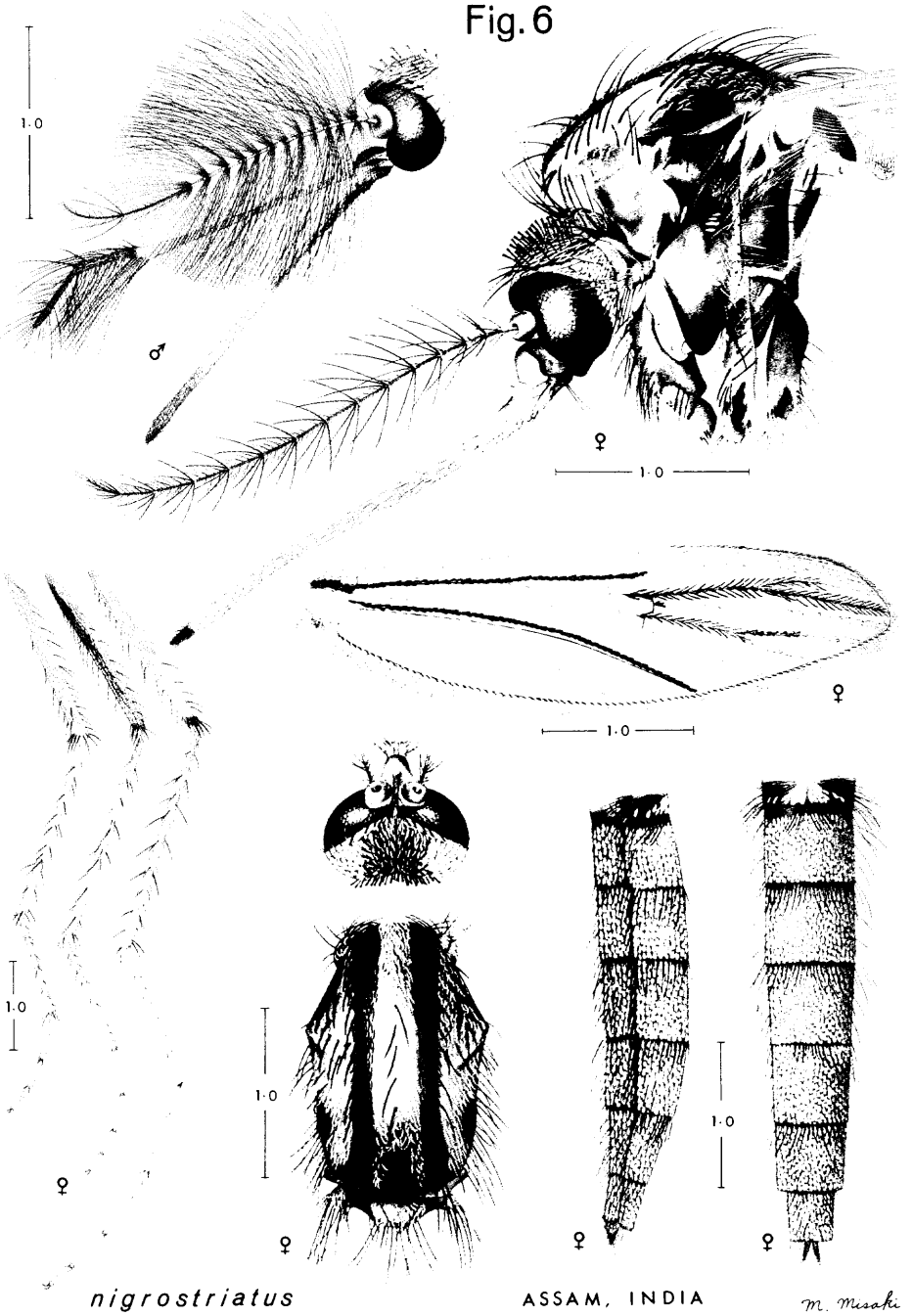


Fig. 6



nigrostriatus ASSAM, INDIA M. Misaki

Fig . 7

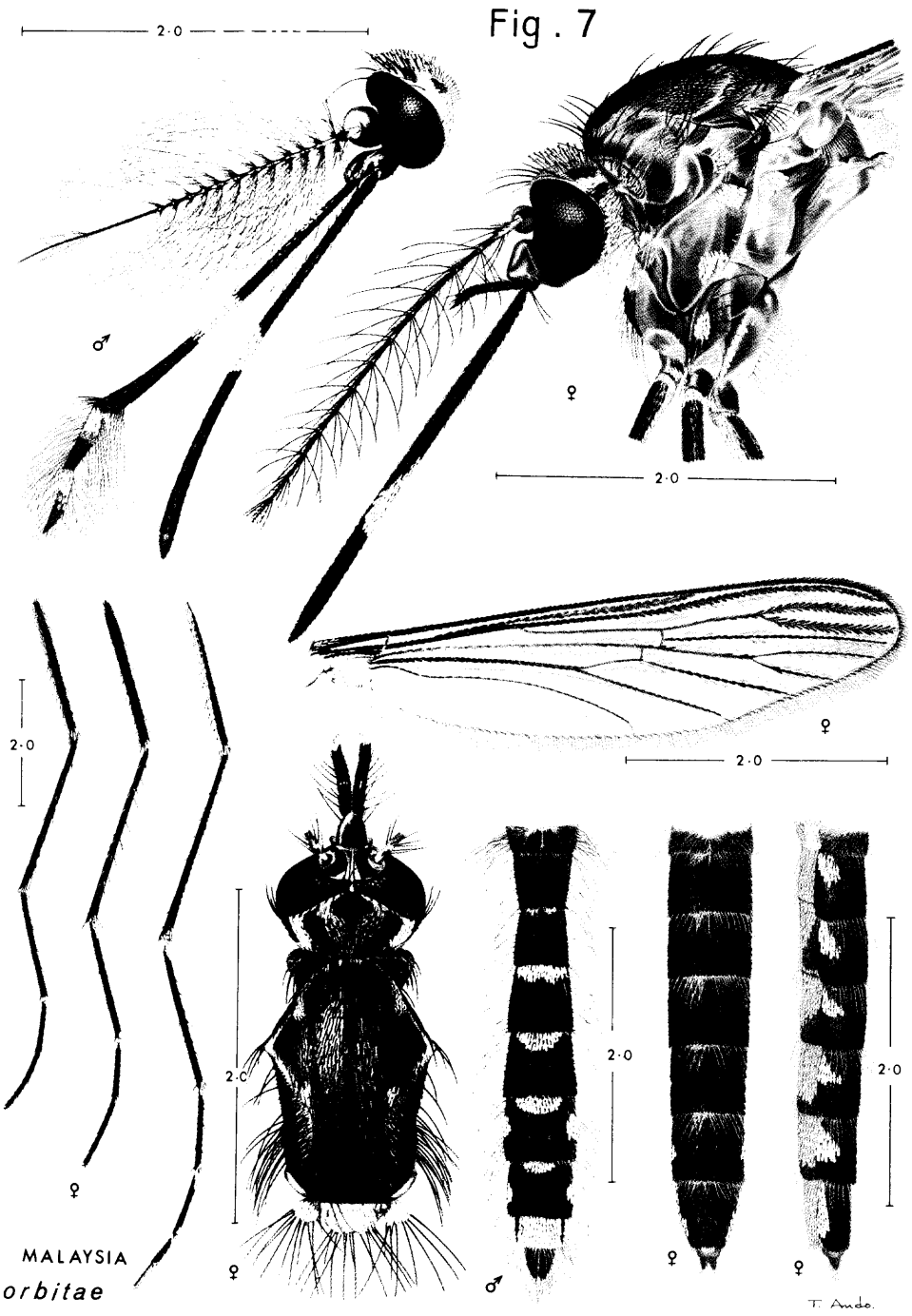


Fig. 8

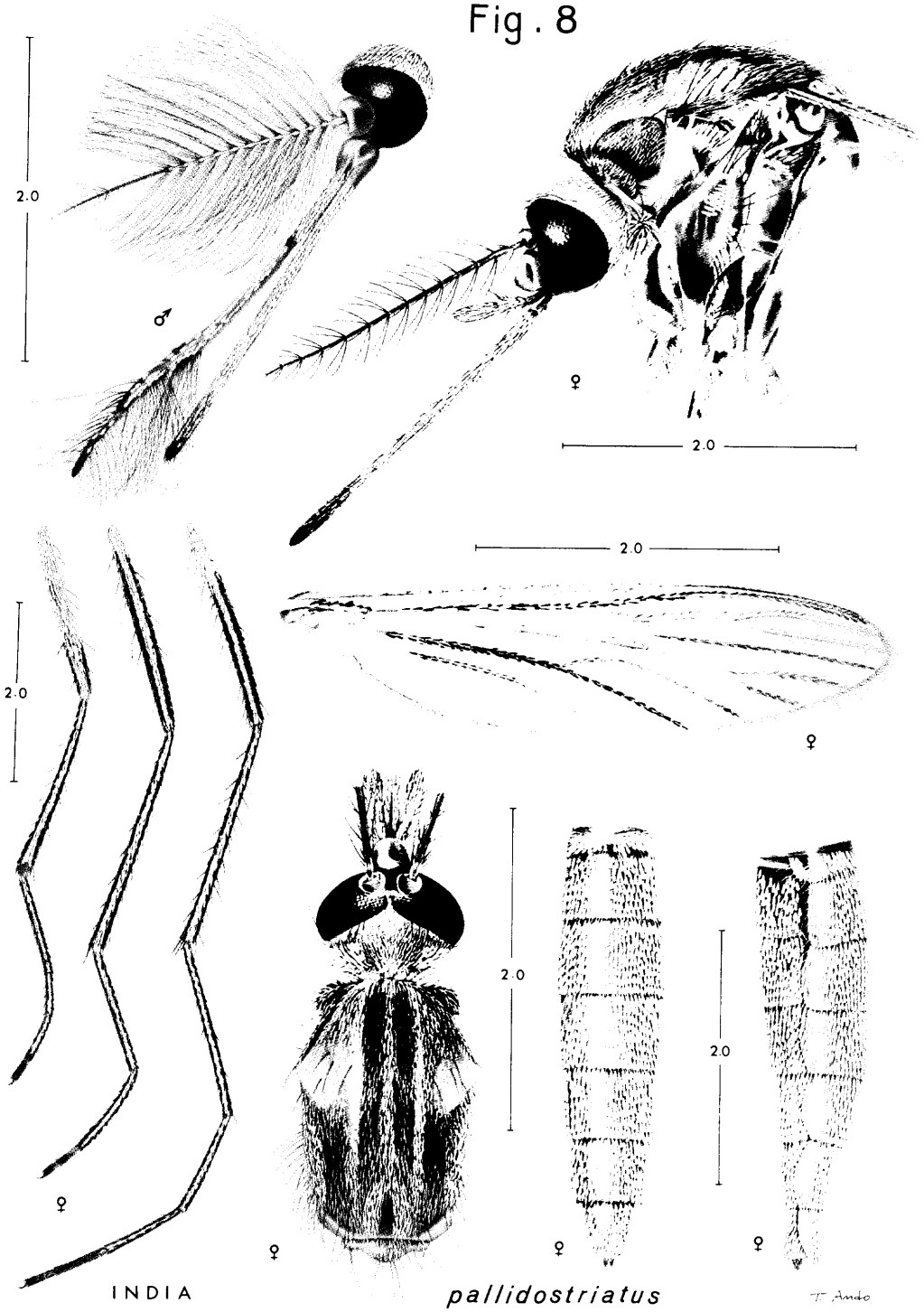
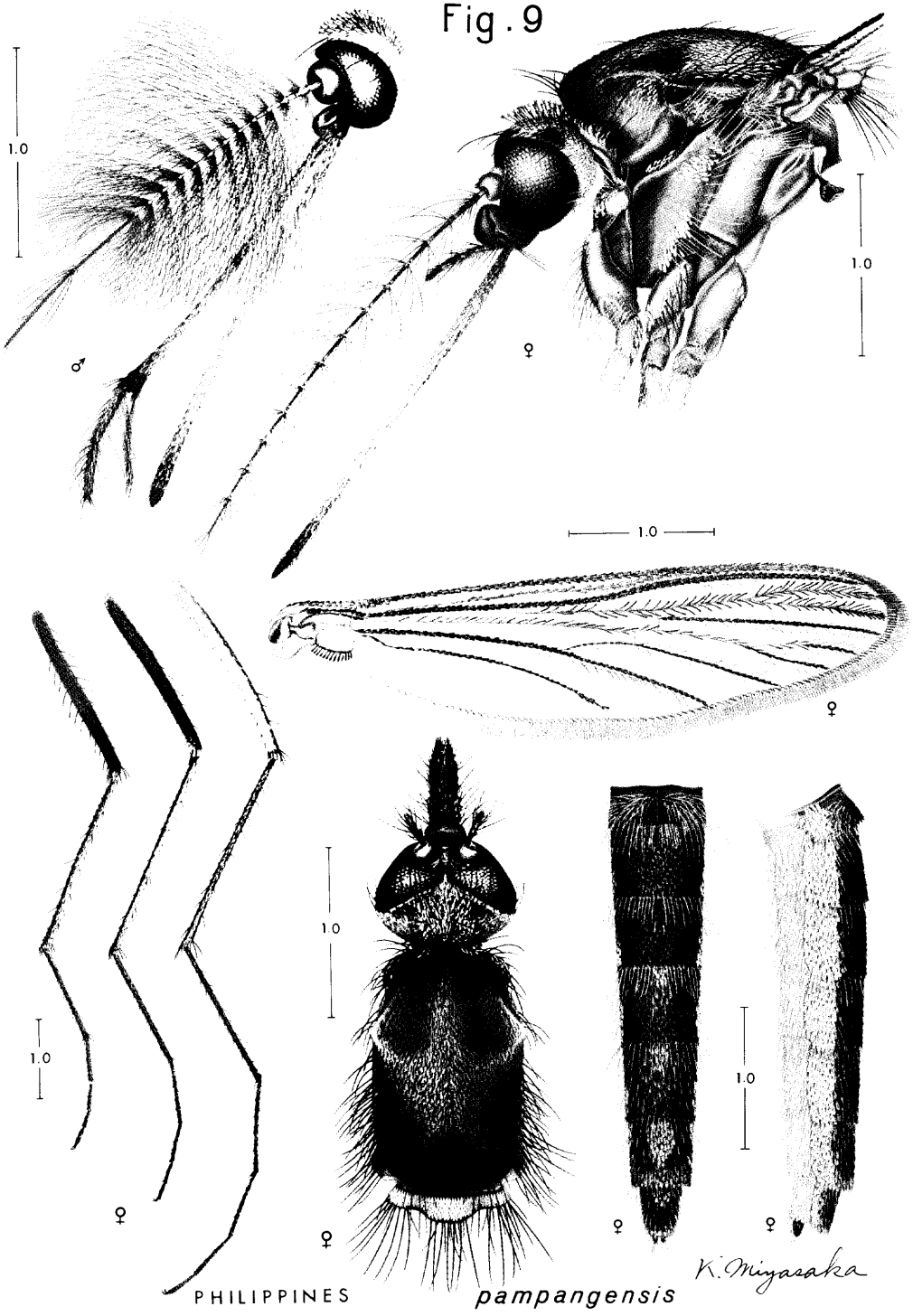


Fig. 9



PHILIPPINES *pampangensis*

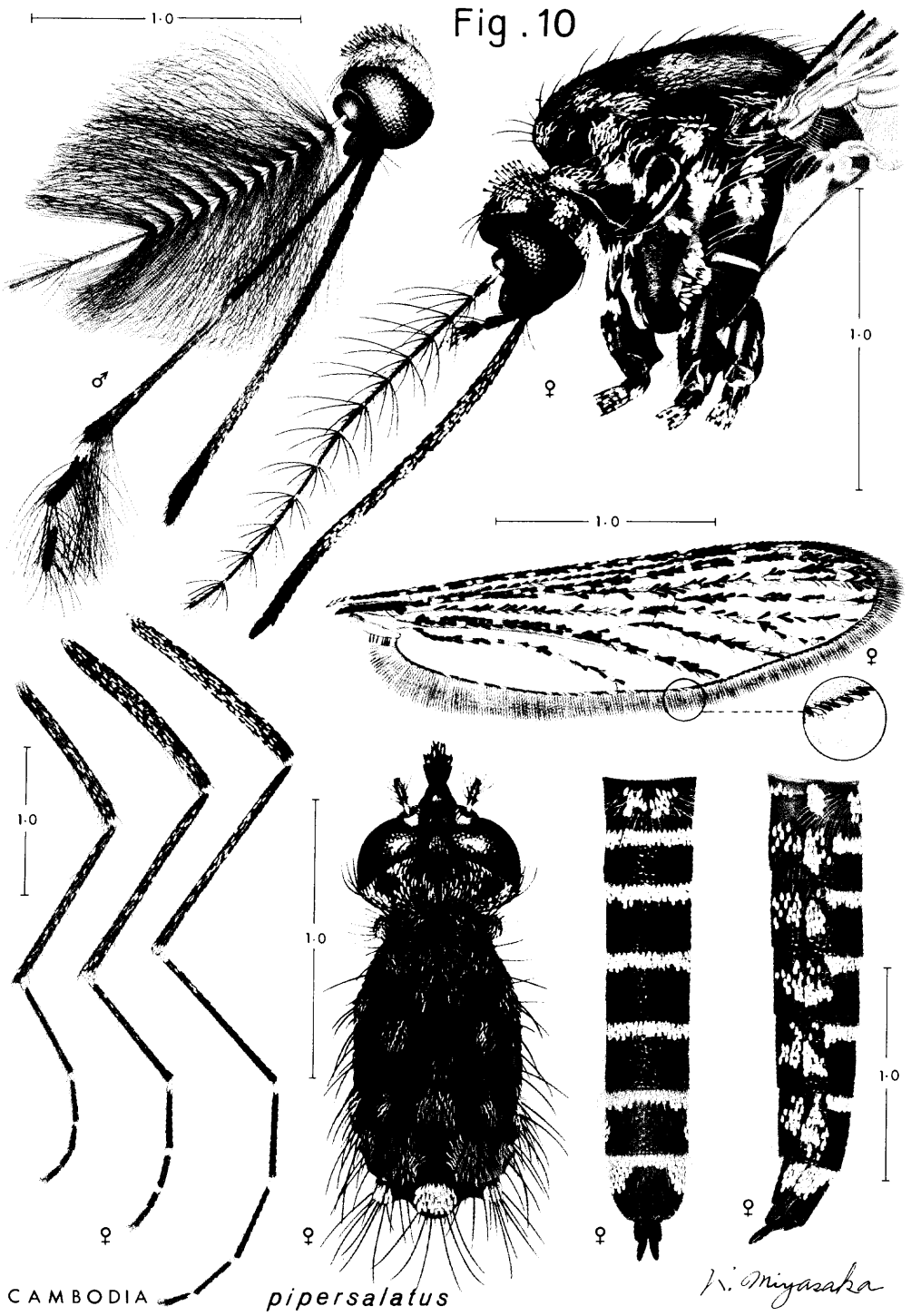


Fig . 10
1·0
♂
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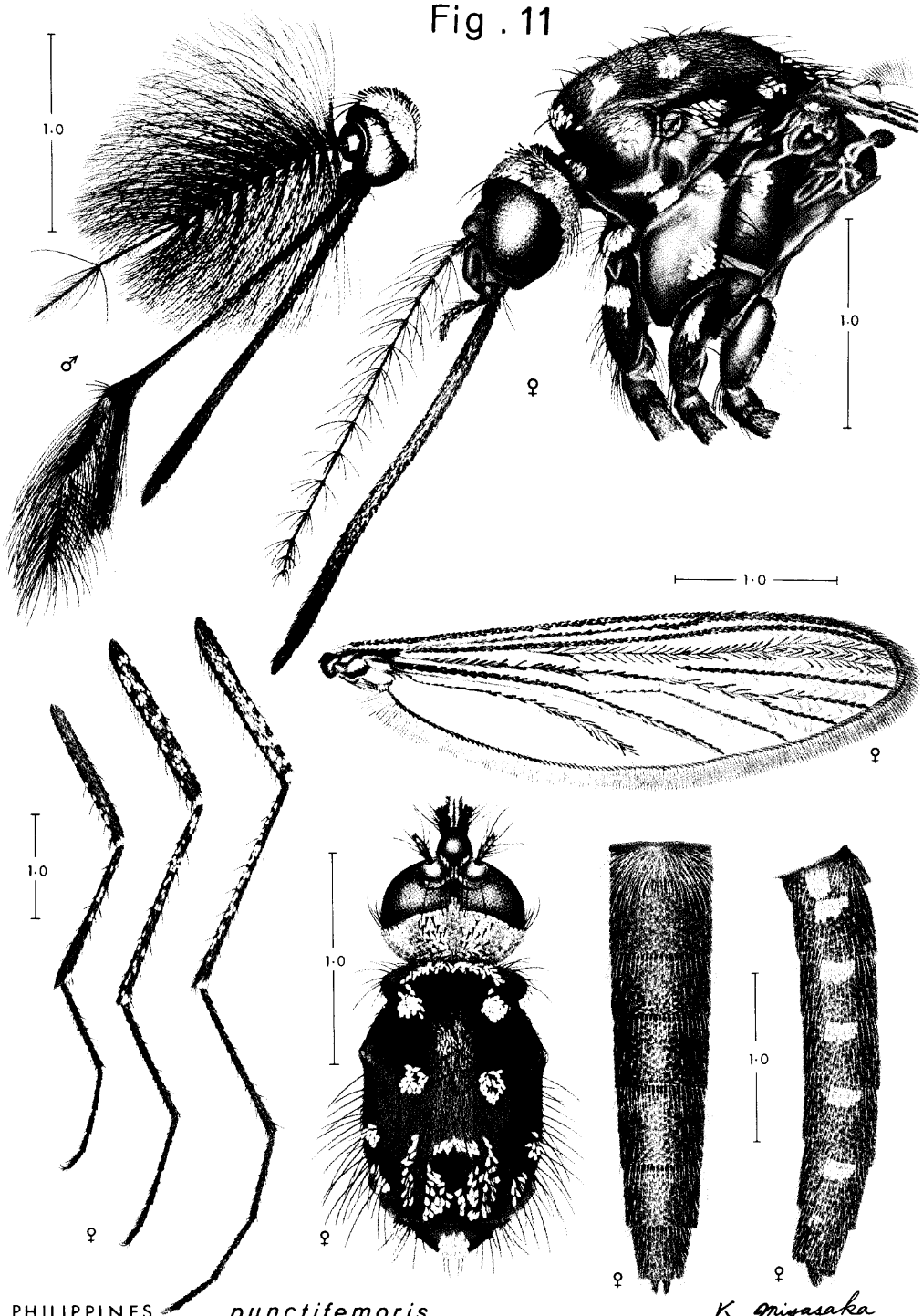
1·0
CAMBODIA
pipersalatus
N. Miyasaka

Fig . 11



PHILIPPINES *punctifemoris* K. Miyasaka

Fig . 12

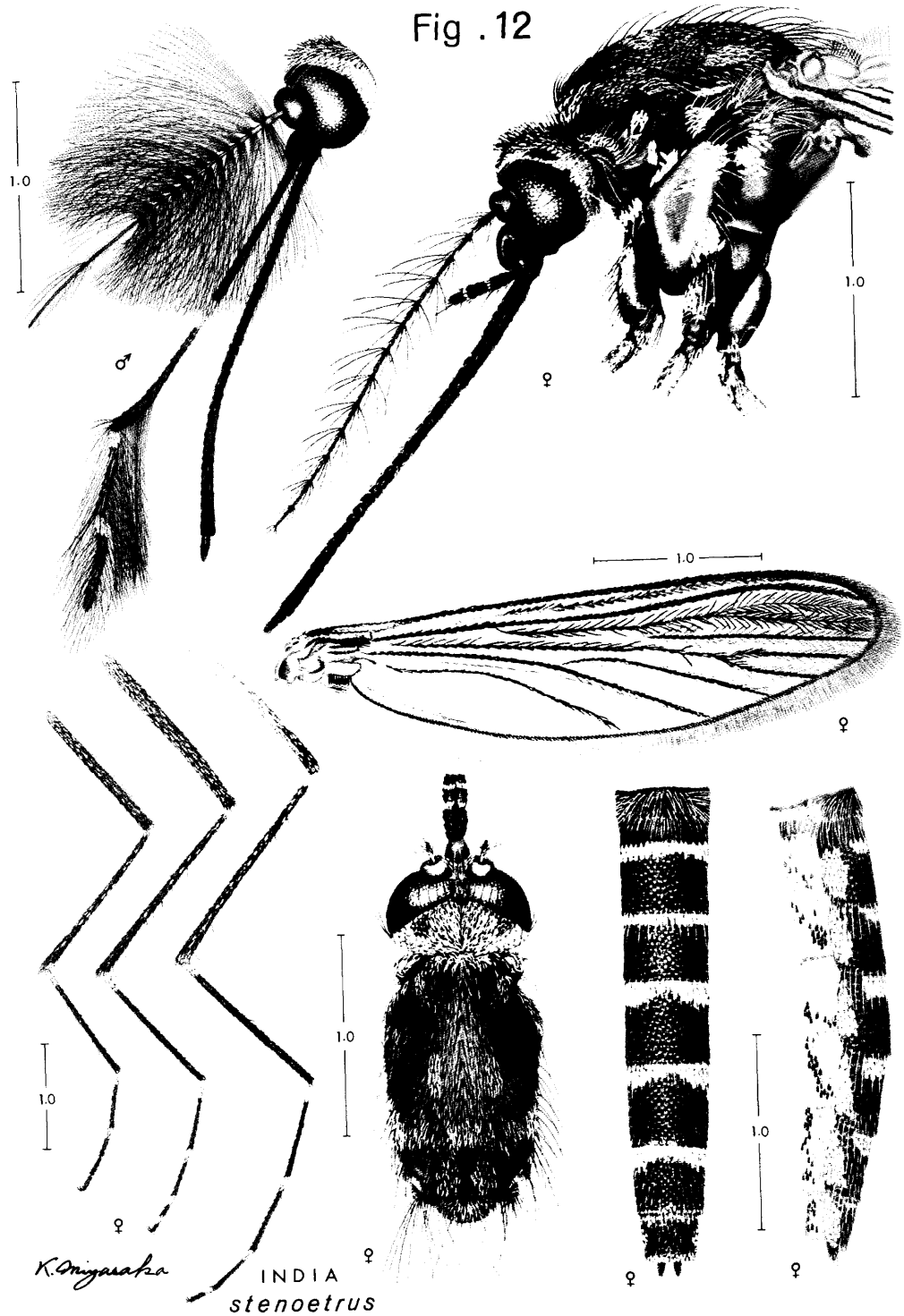
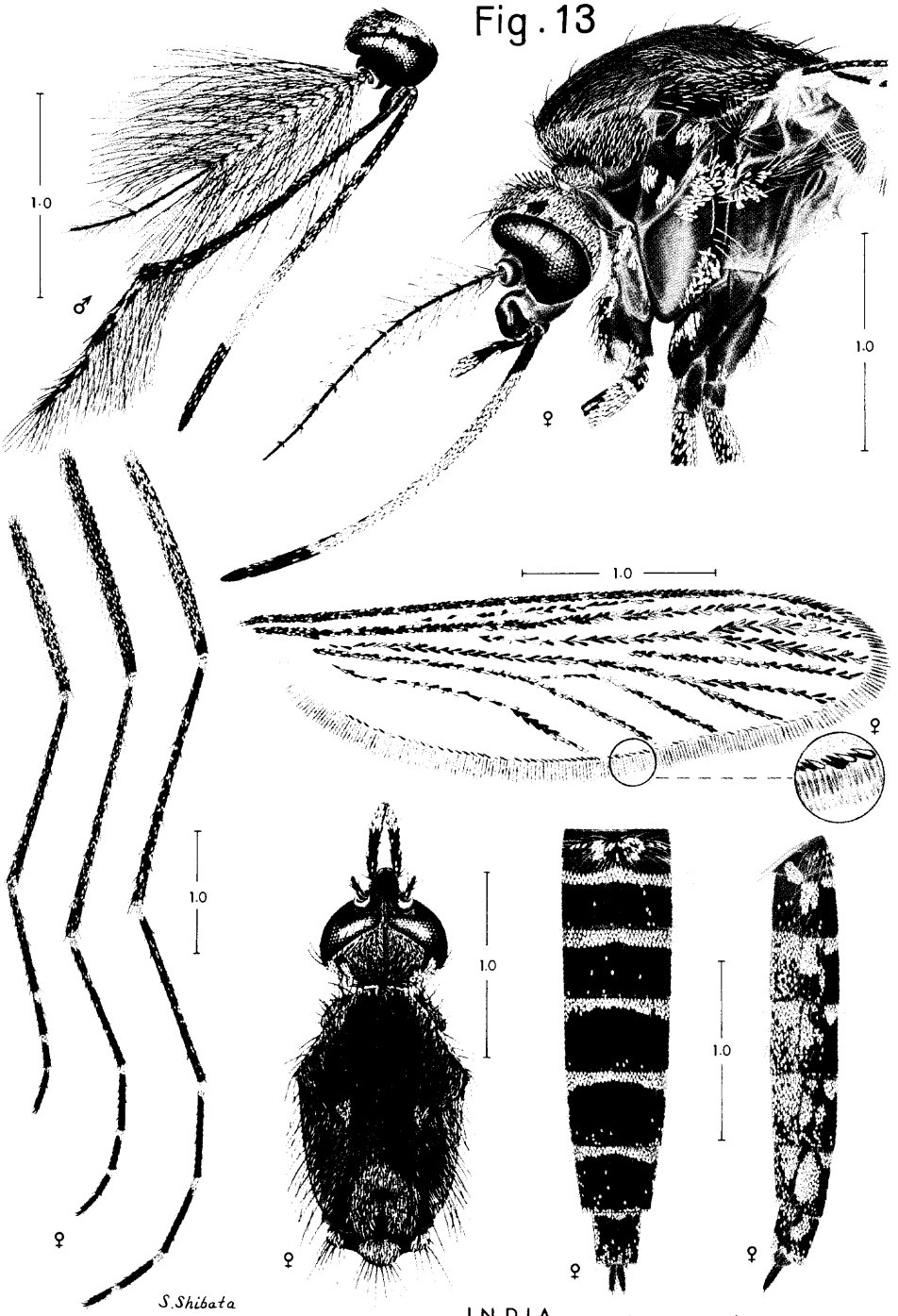
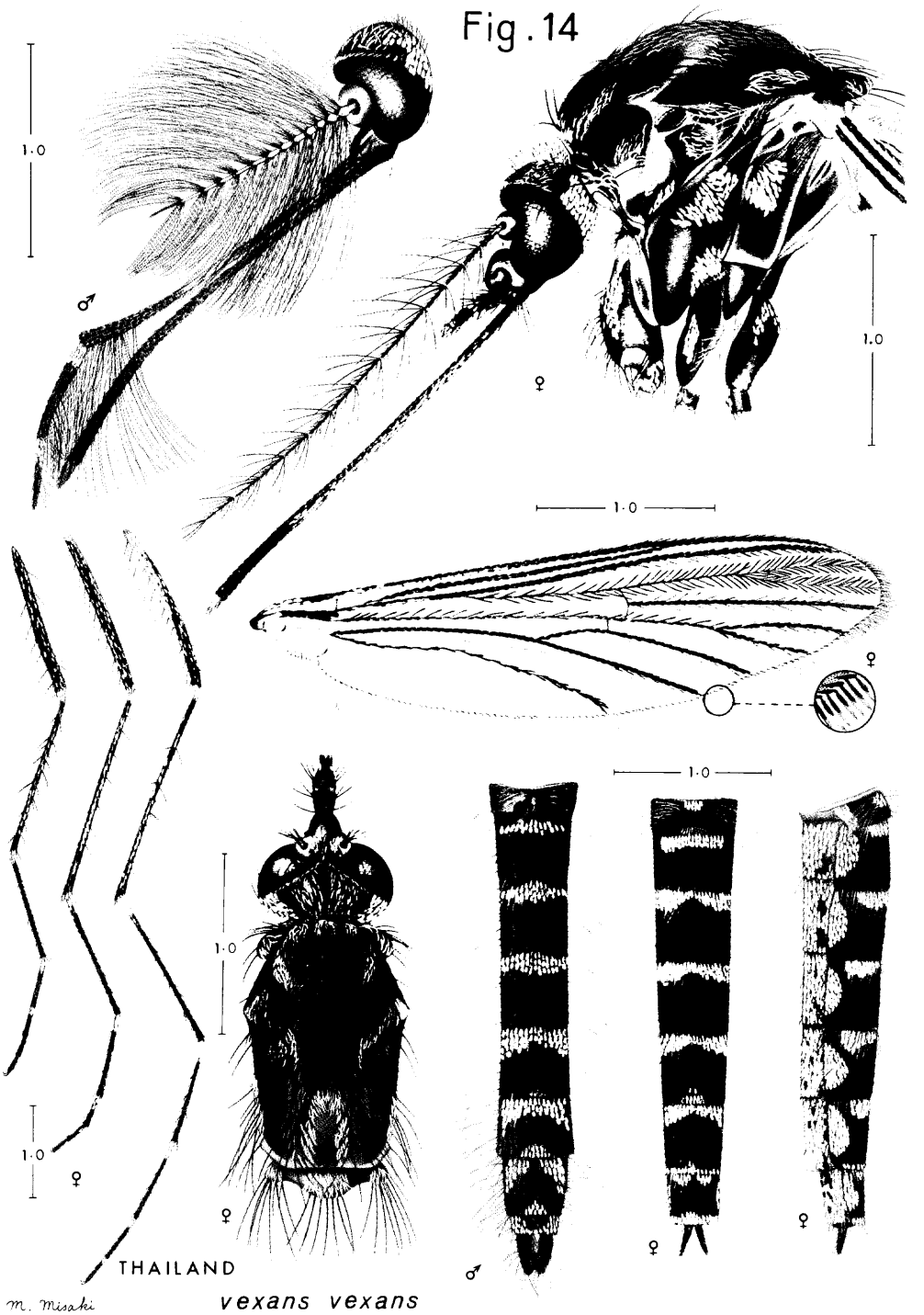


Fig. 13



INDIA *taeniorhynchoides*

Fig. 14

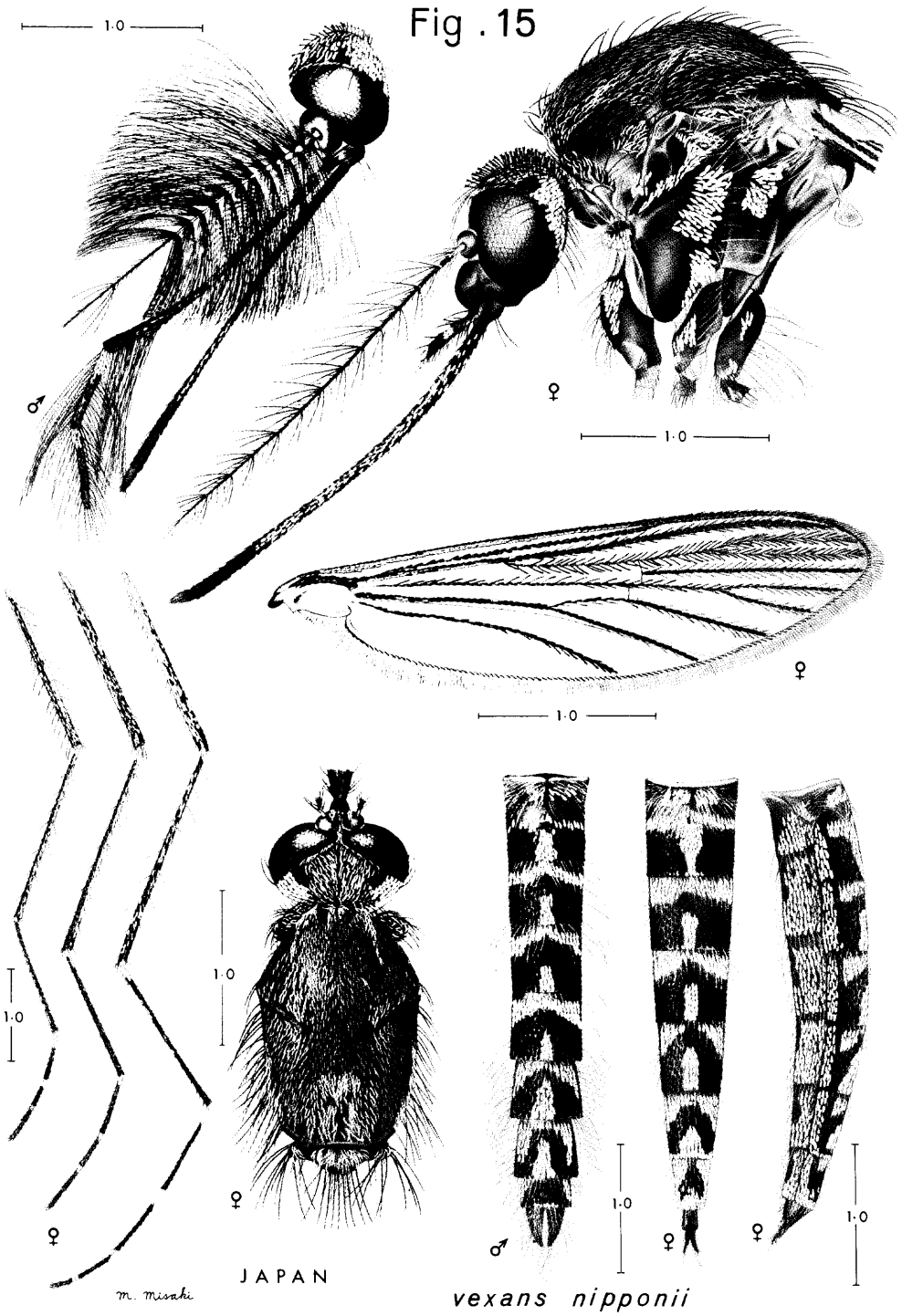


THAILAND

m. misaki

vexans vexans

Fig . 15



vexans nipponii

Fig.16

FEMALE TARSOMERES 5 AND POSTTARSI

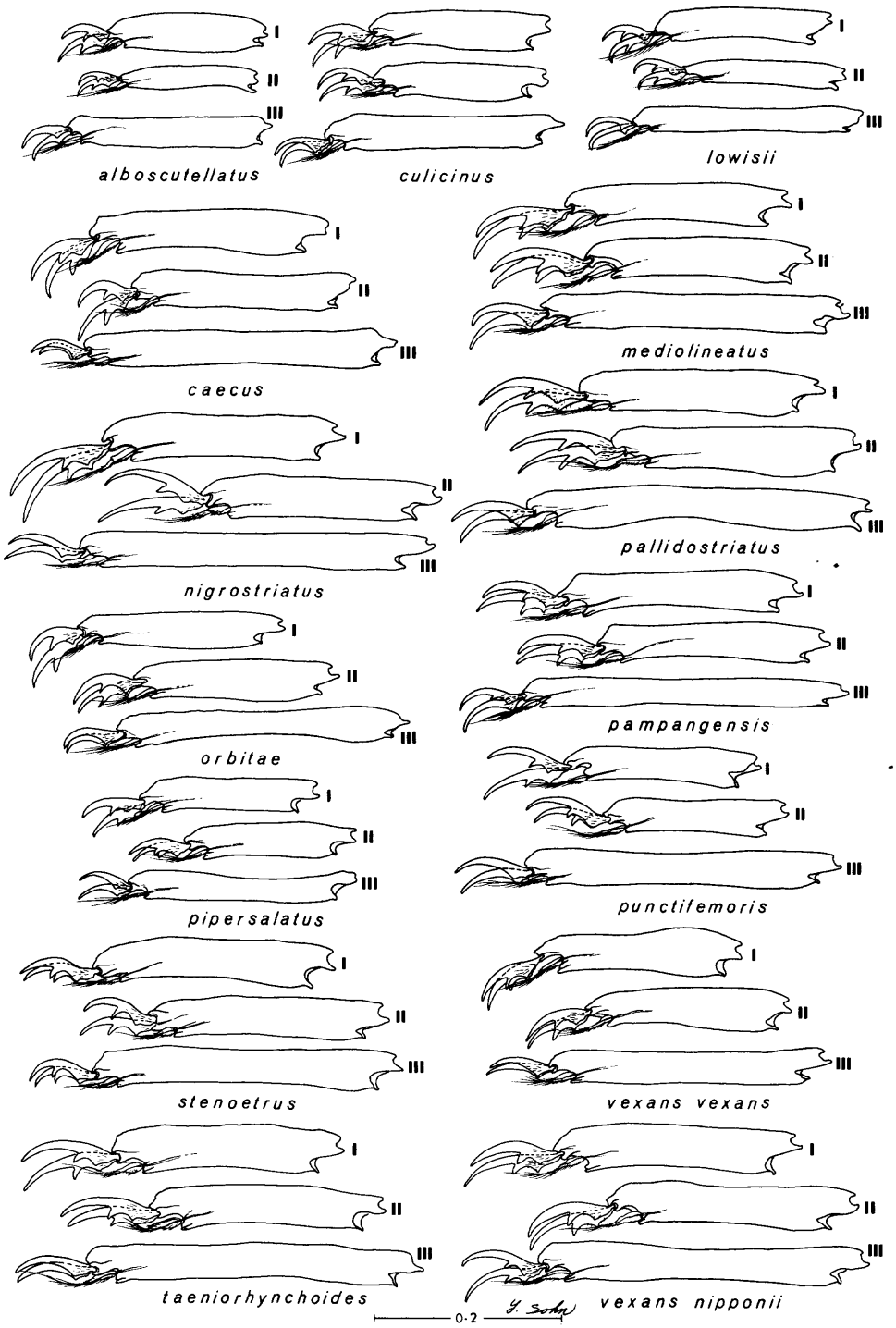


Fig. 17

MALE TARSOMERES 5 AND POSTTARSI

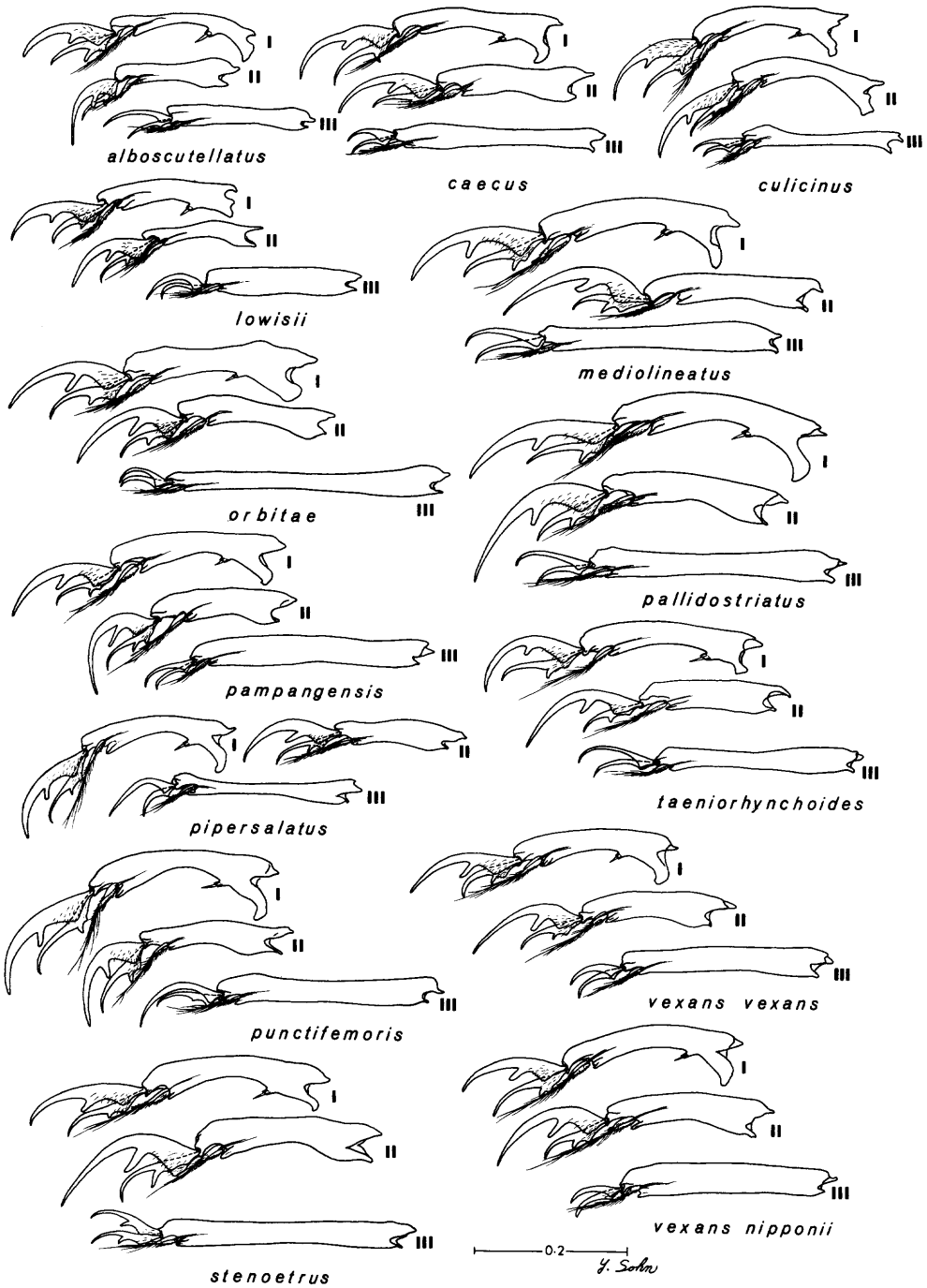
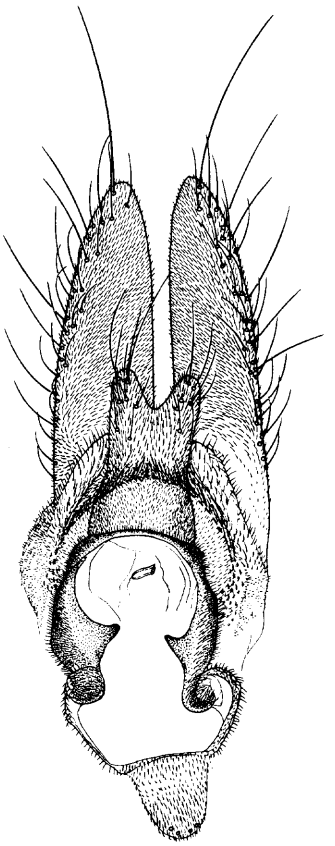
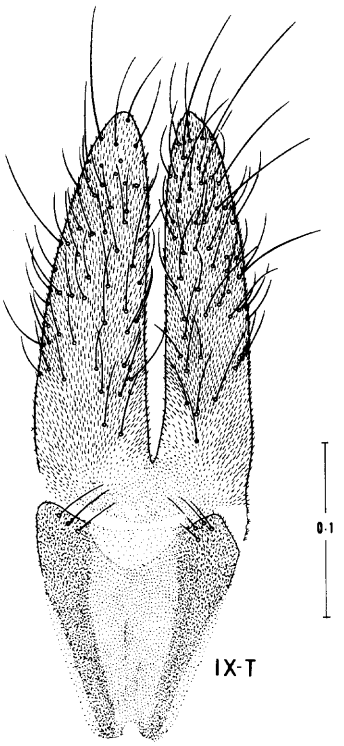
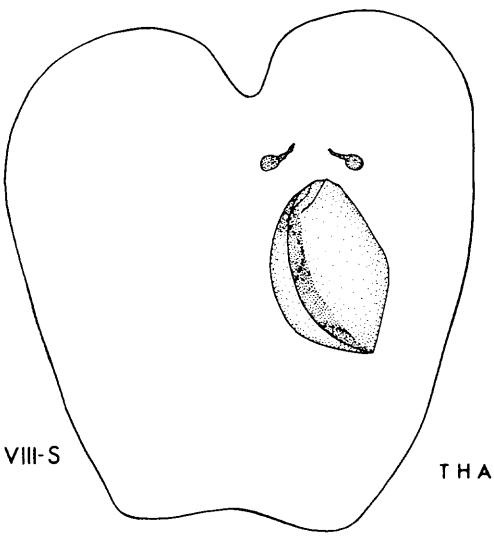
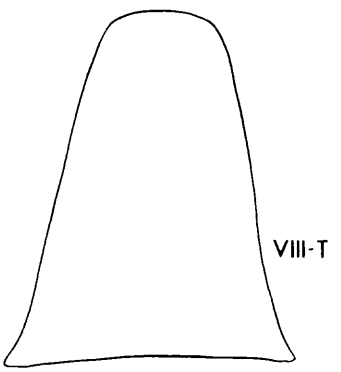


Fig. 18







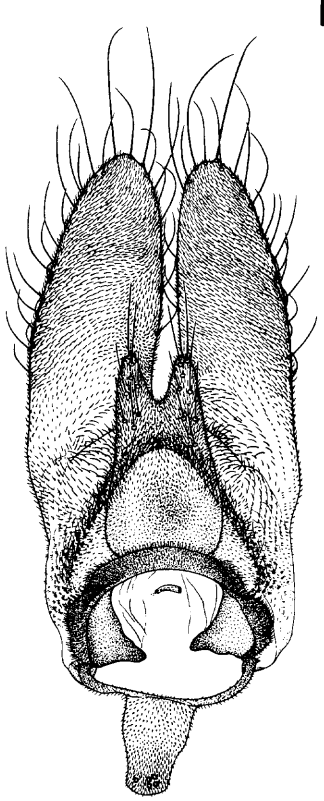


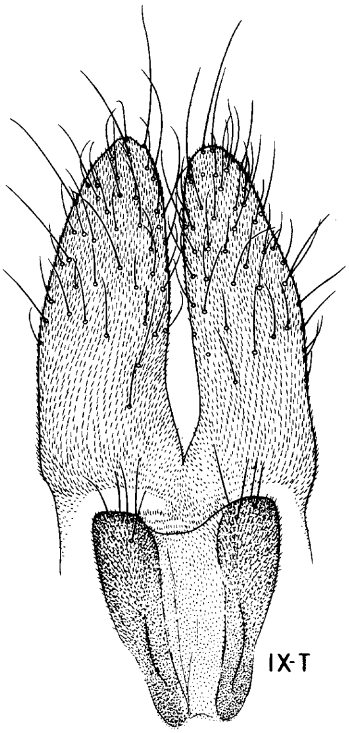
THAILAND

M. Hasumura

alboscutellatus

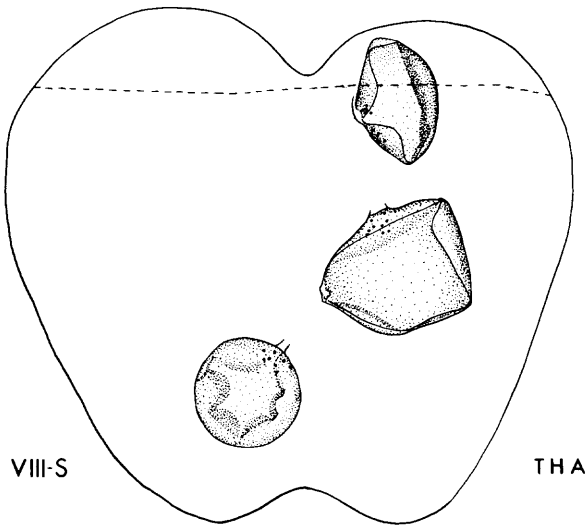
Fig. 19





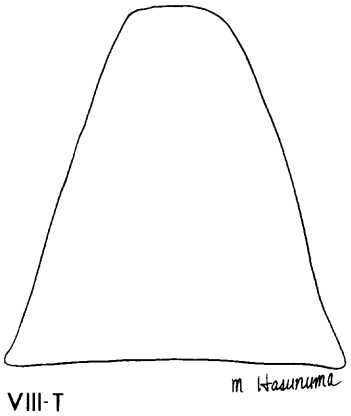
IX-T

0.1



VIII-S

THAILAND

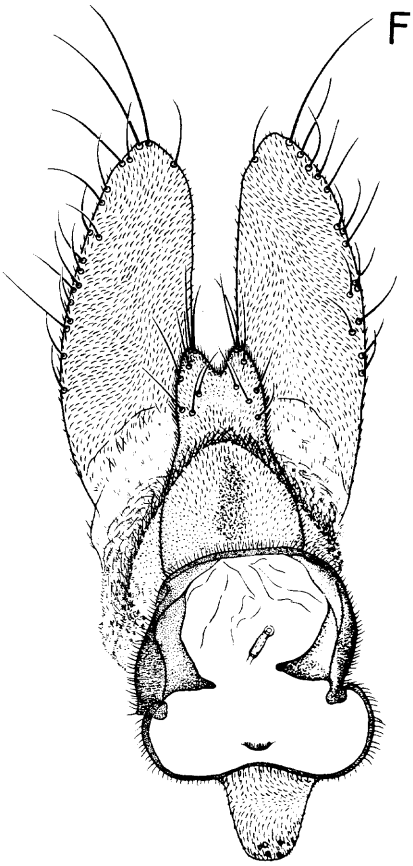


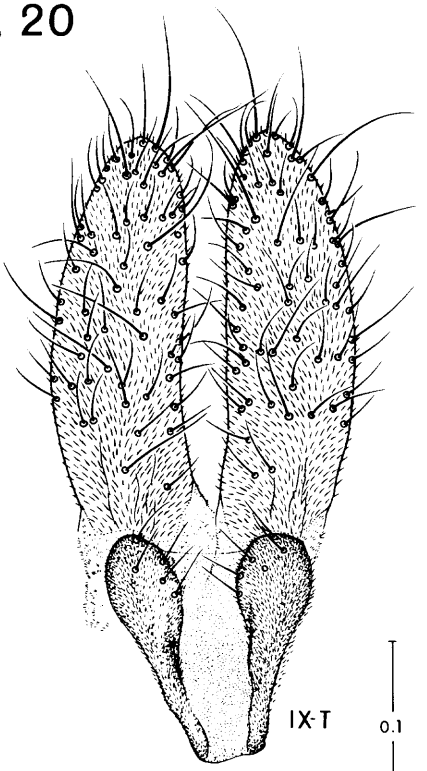
VIII-T

M Hasuruma

caecus

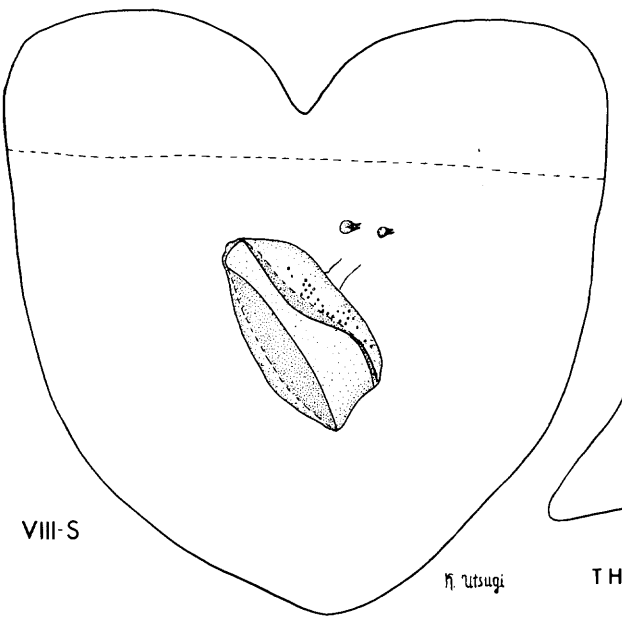
Fig . 20





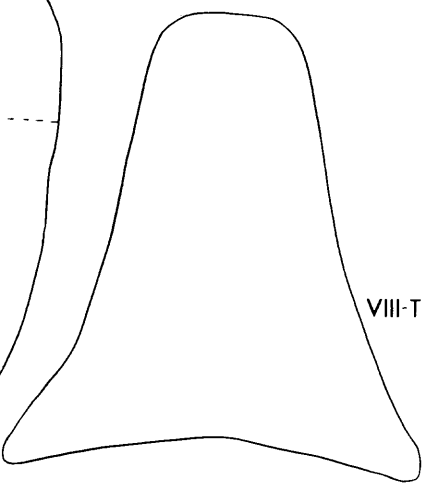
IX-T

0.1



VIII-S

K. Utsugi



VIII-T

THAILAND

culicinus

Fig. 21

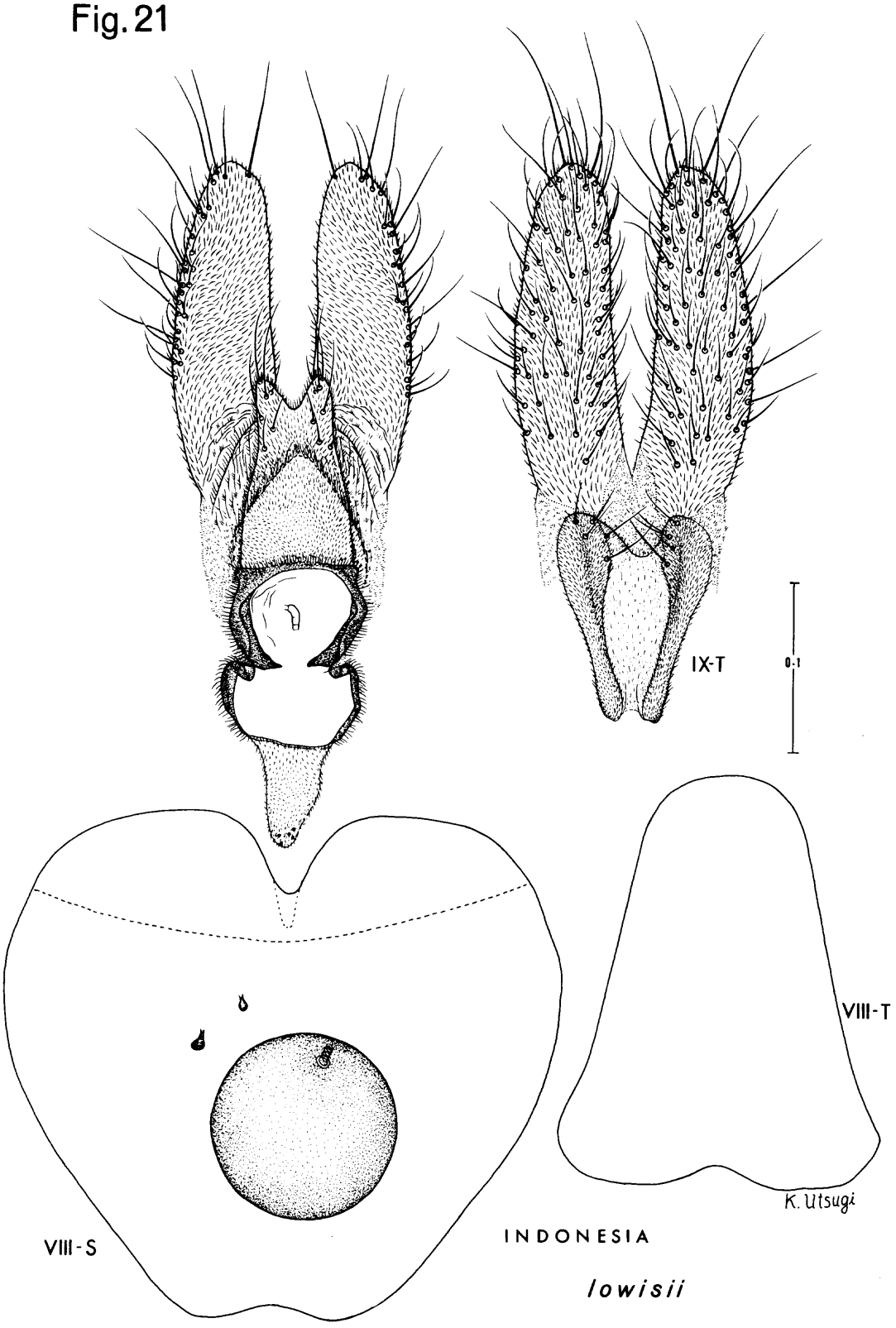
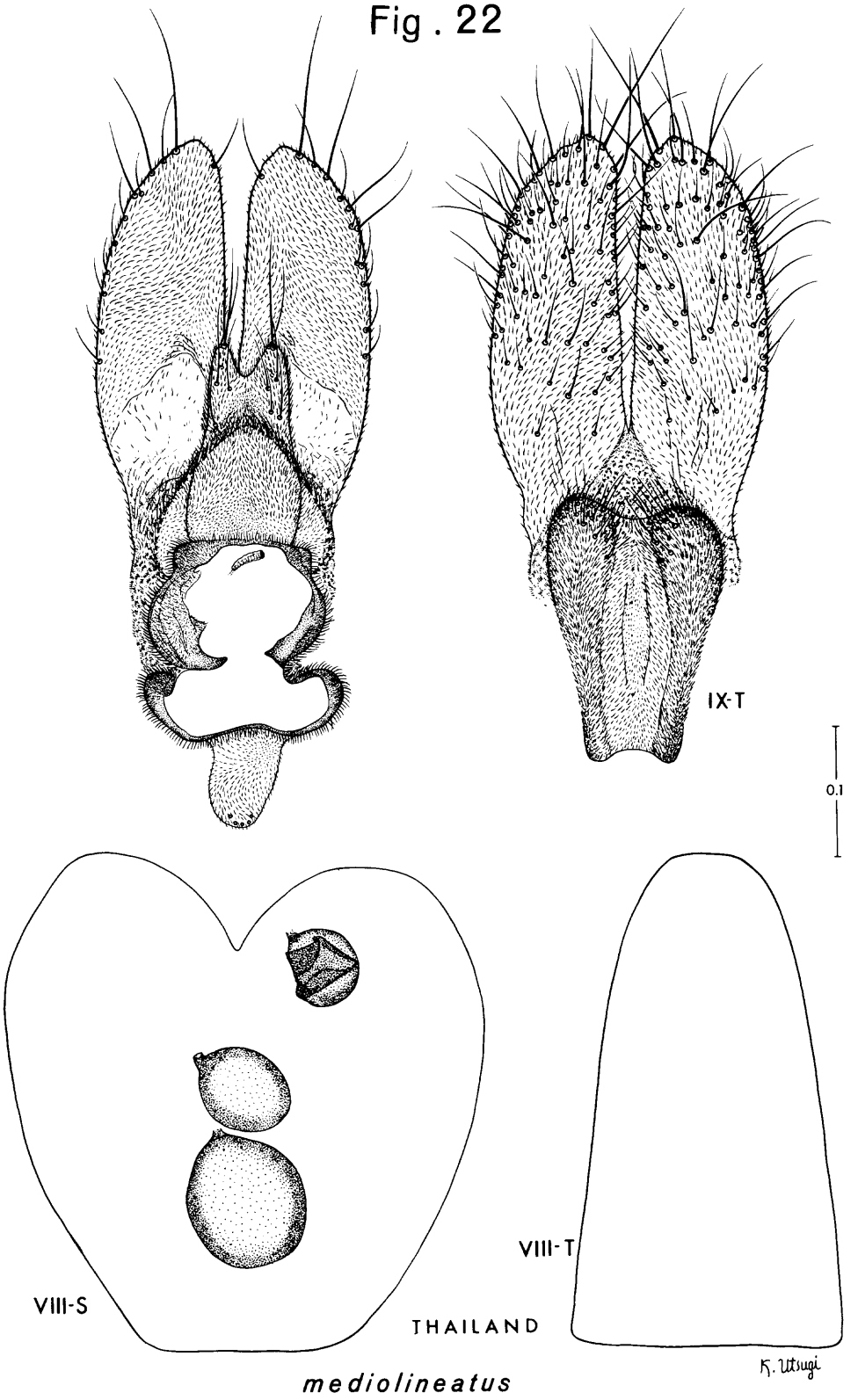
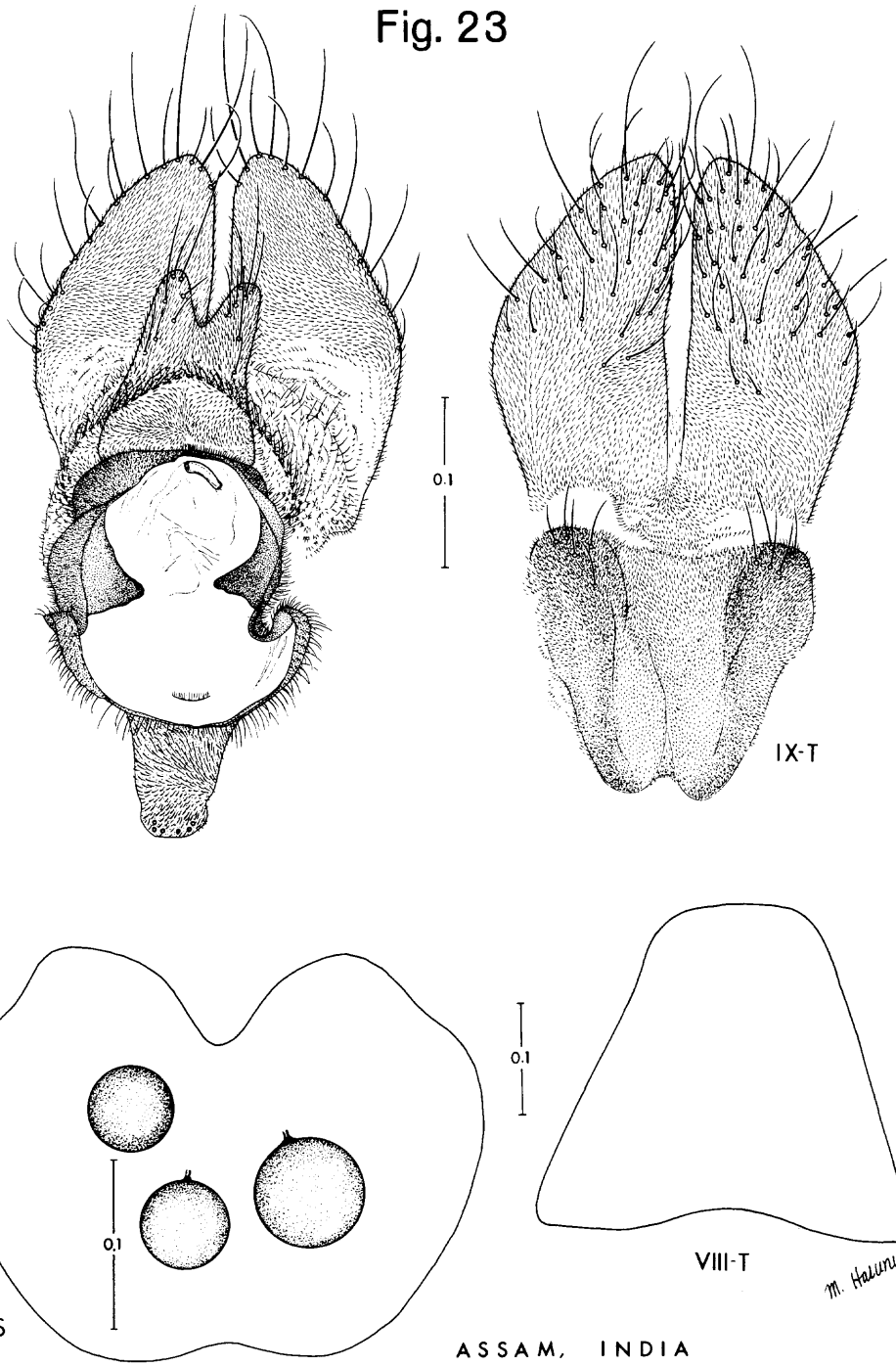


Fig . 22



mediolineatus

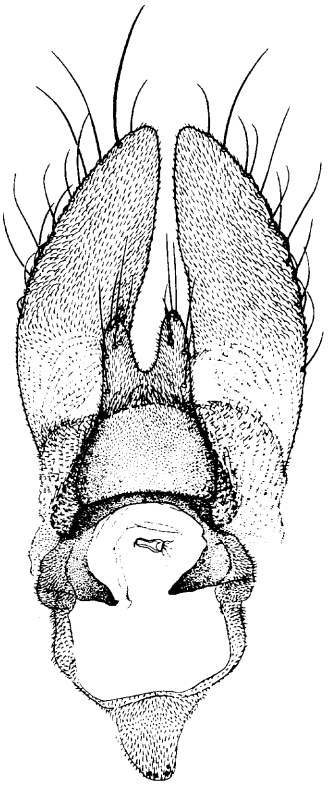
Fig. 23

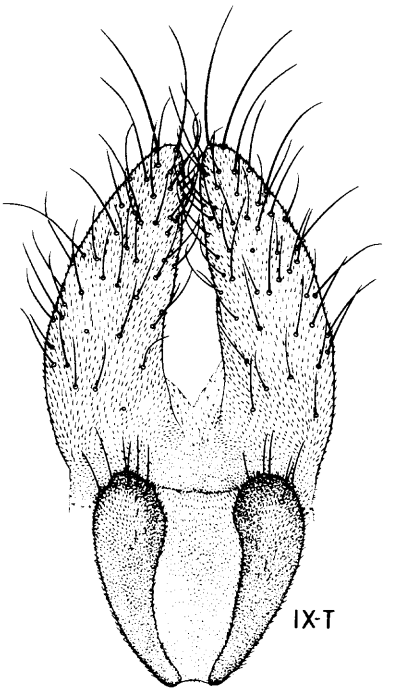


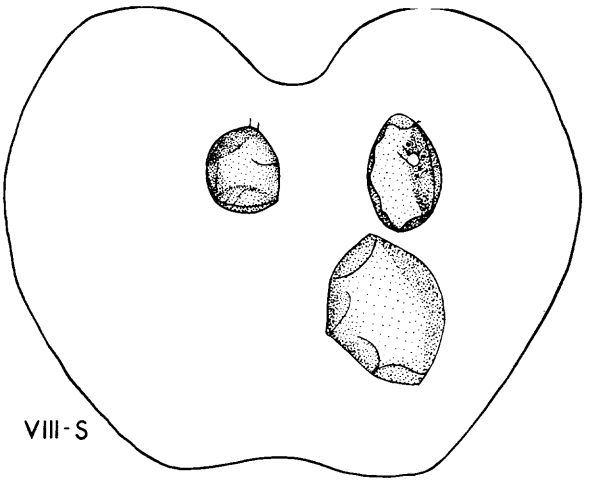
ASSAM, INDIA

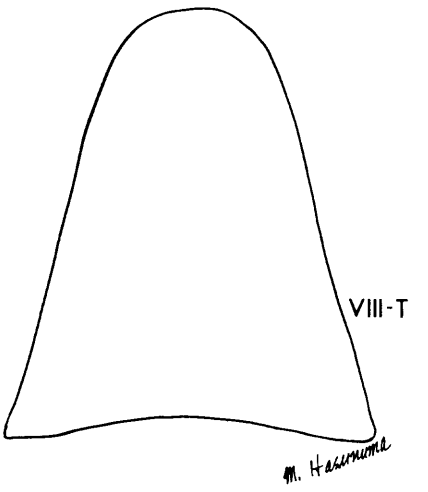
nigrostriatus

Fig. 24







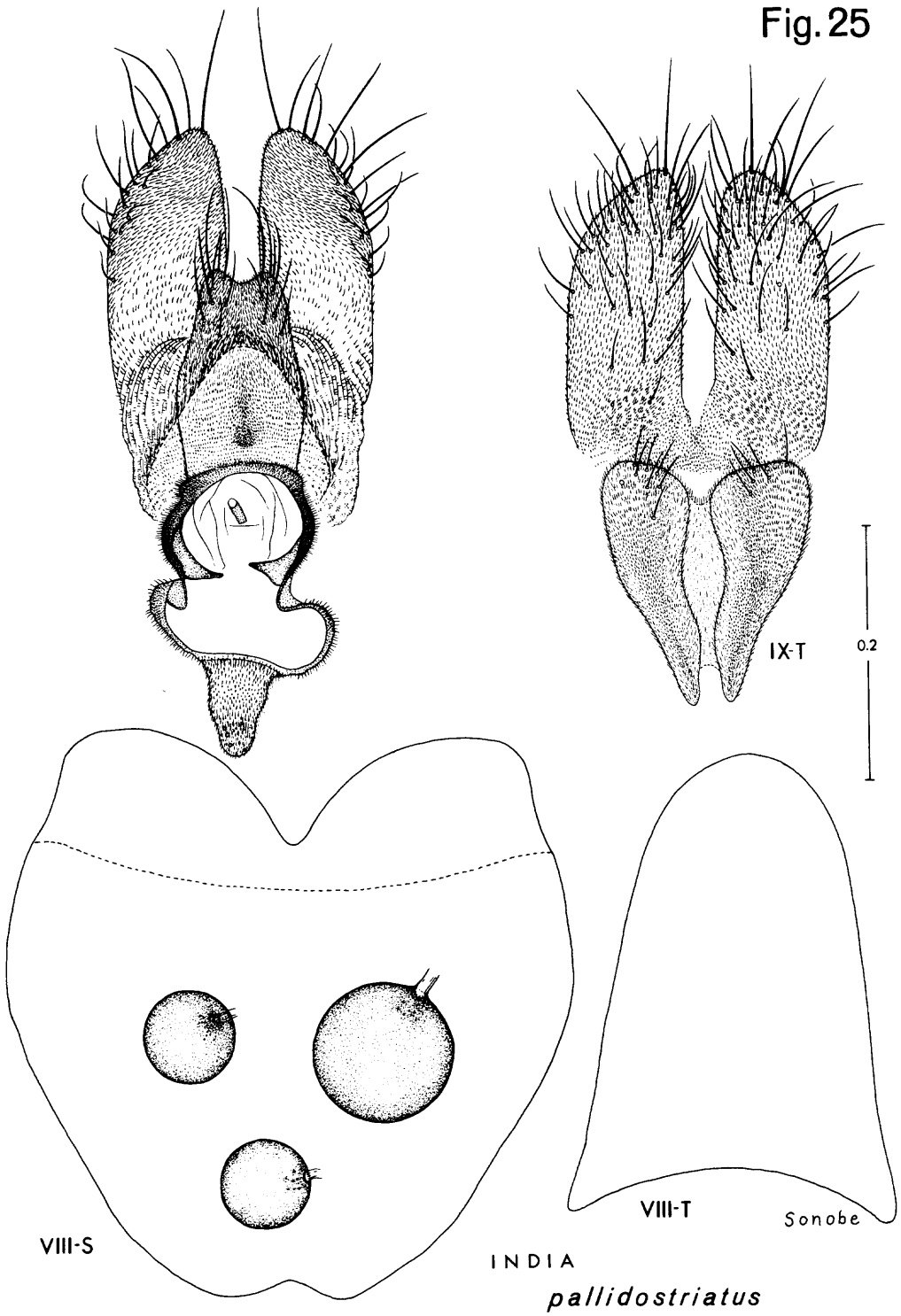


MALAYSIA

M. Hasumura

orbitae

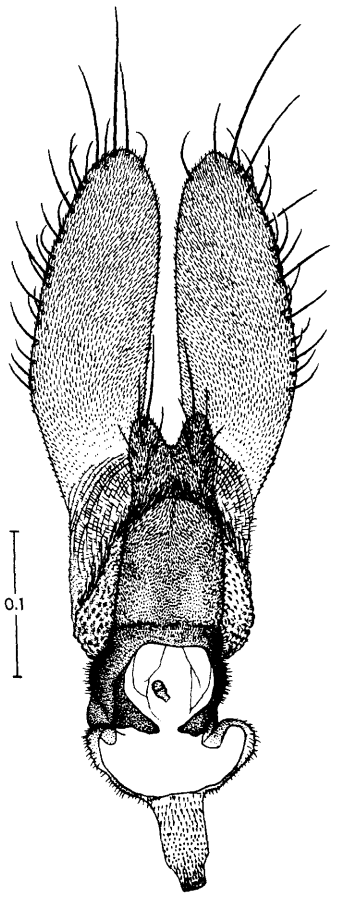
Fig. 25

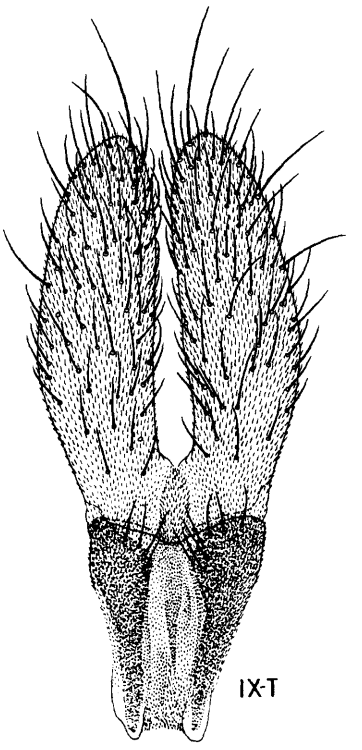


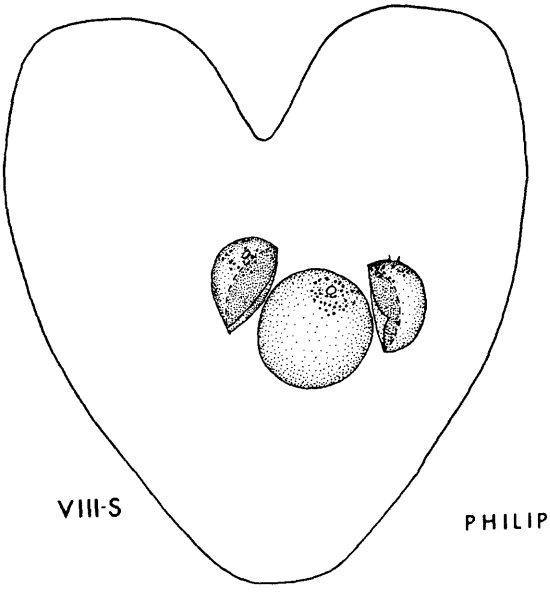
INDIA

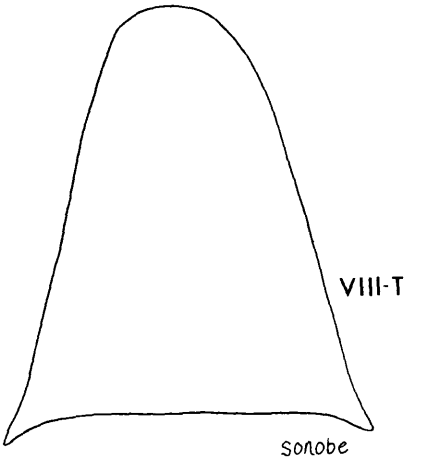
pallidostriatus

Fig . 26









PHILIPPINES

pampangensis

Fig. 27

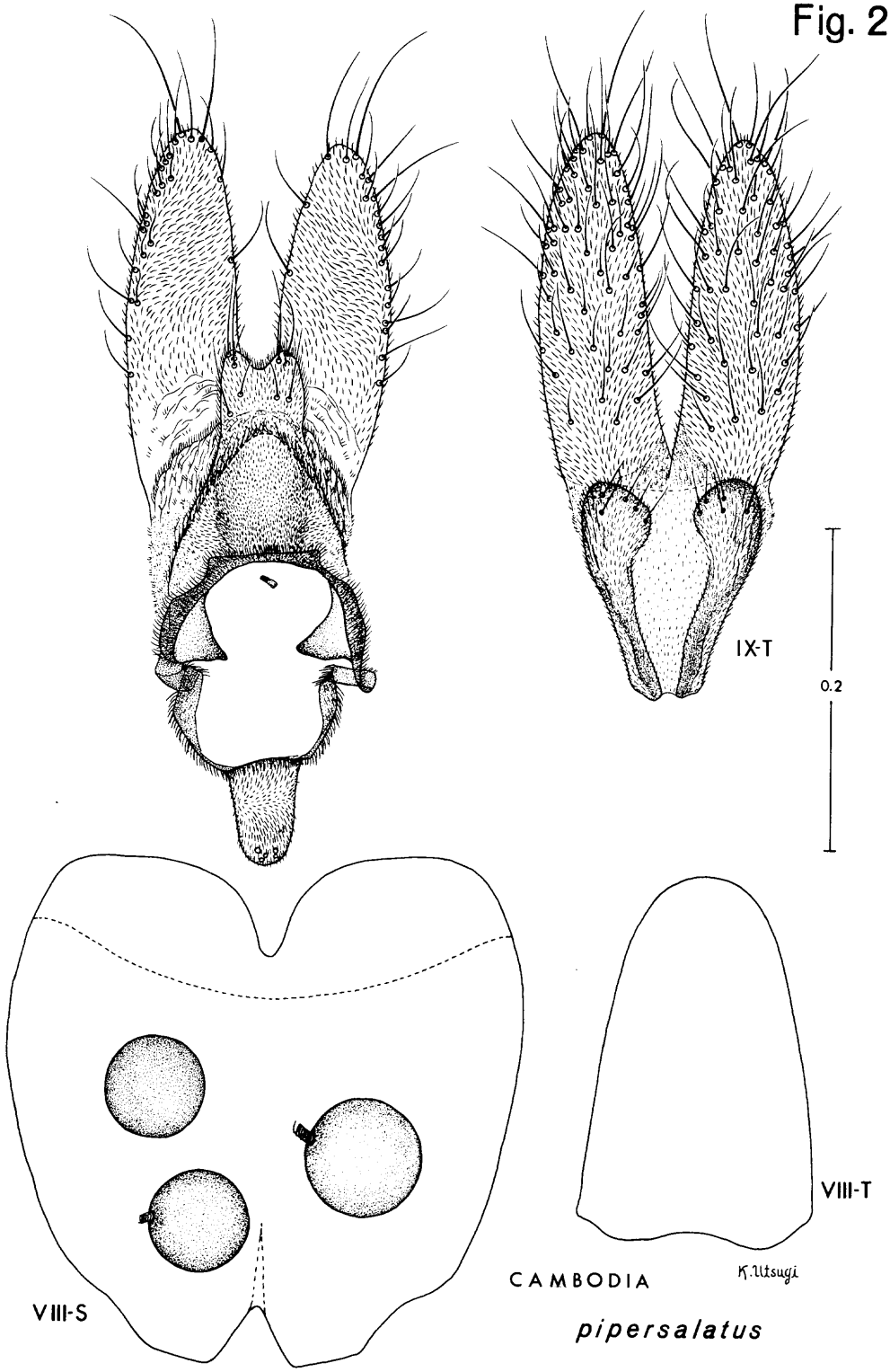
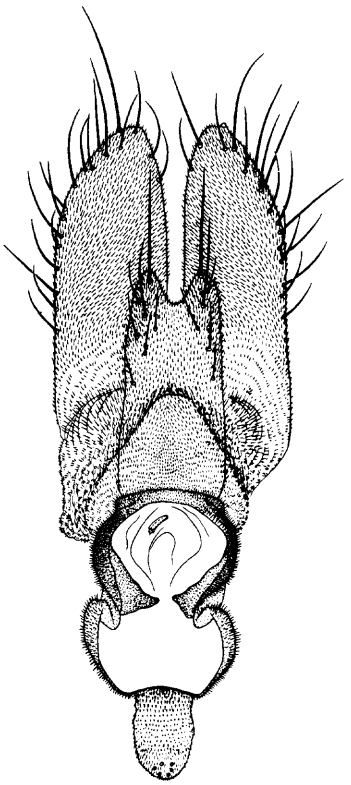
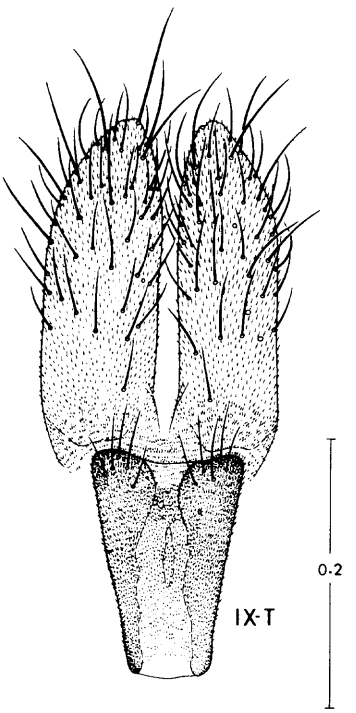
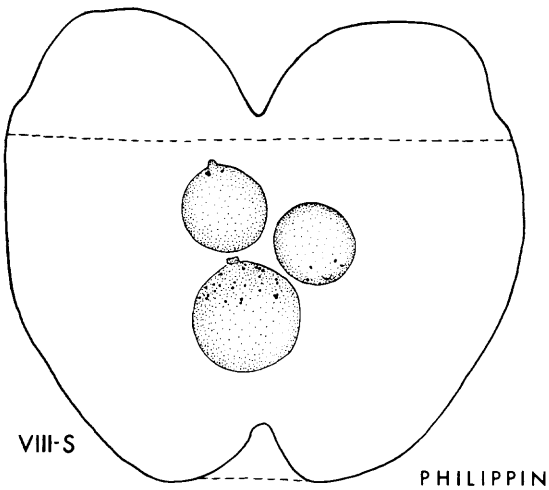
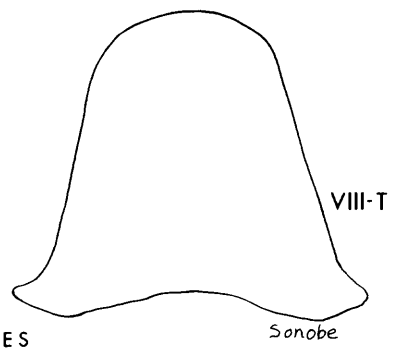


Fig . 28









PHILIPPINES

punctifemoris

Fig. 29

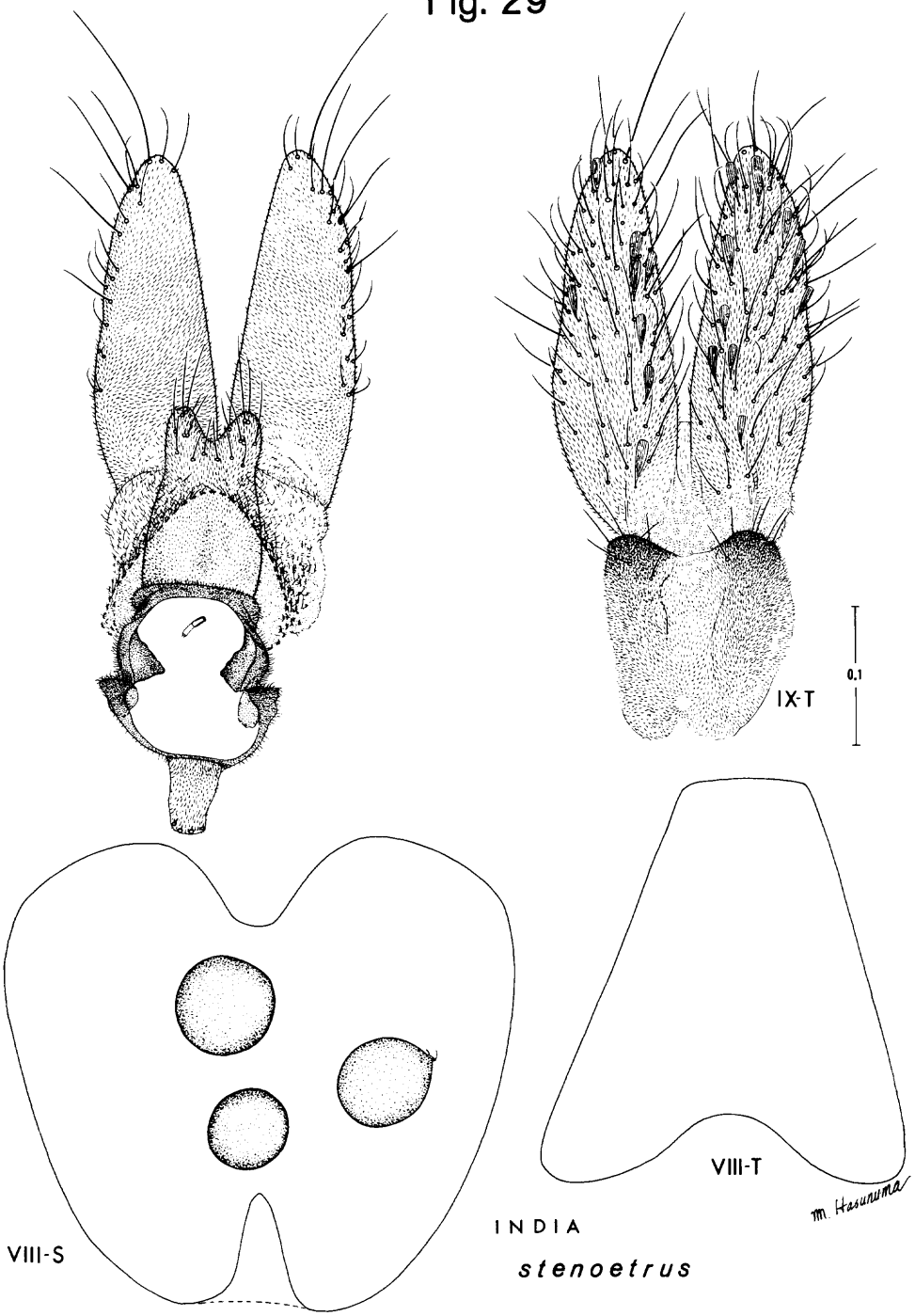
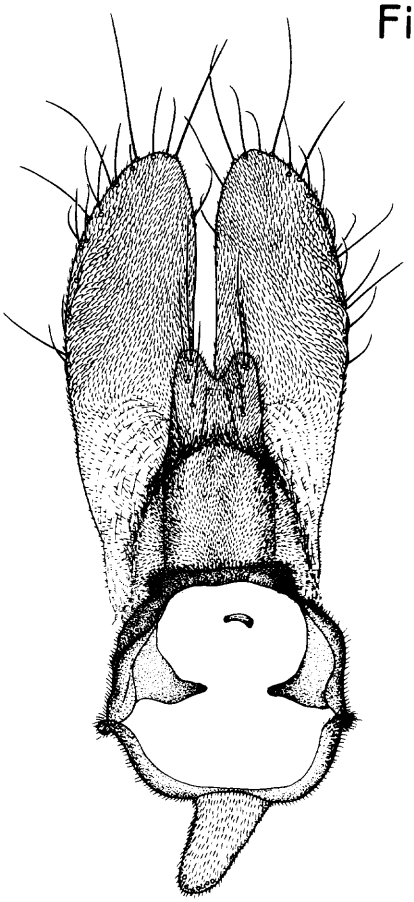
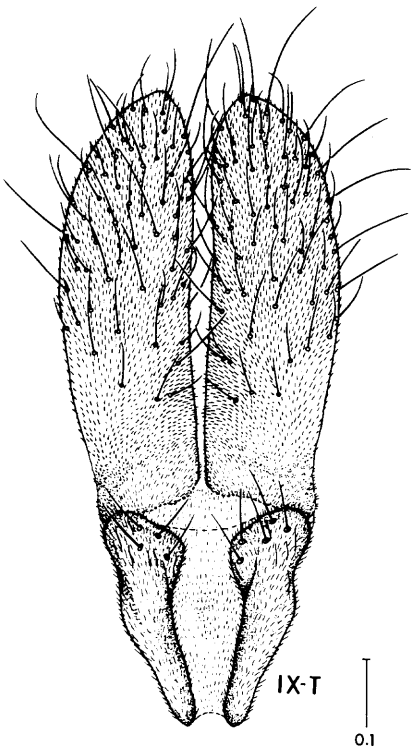


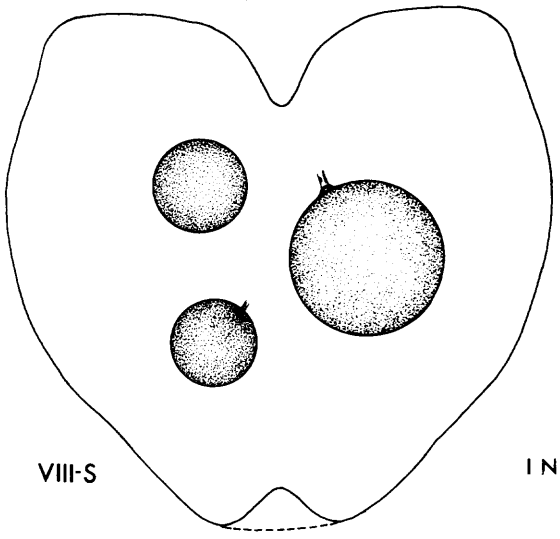
Fig. 30



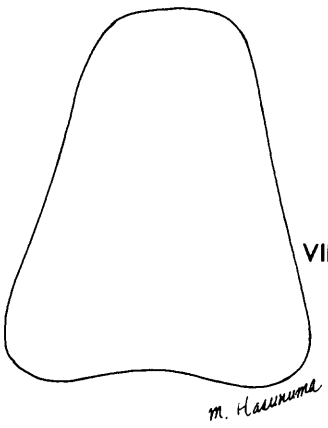


IX-T

0.1



VIII-S



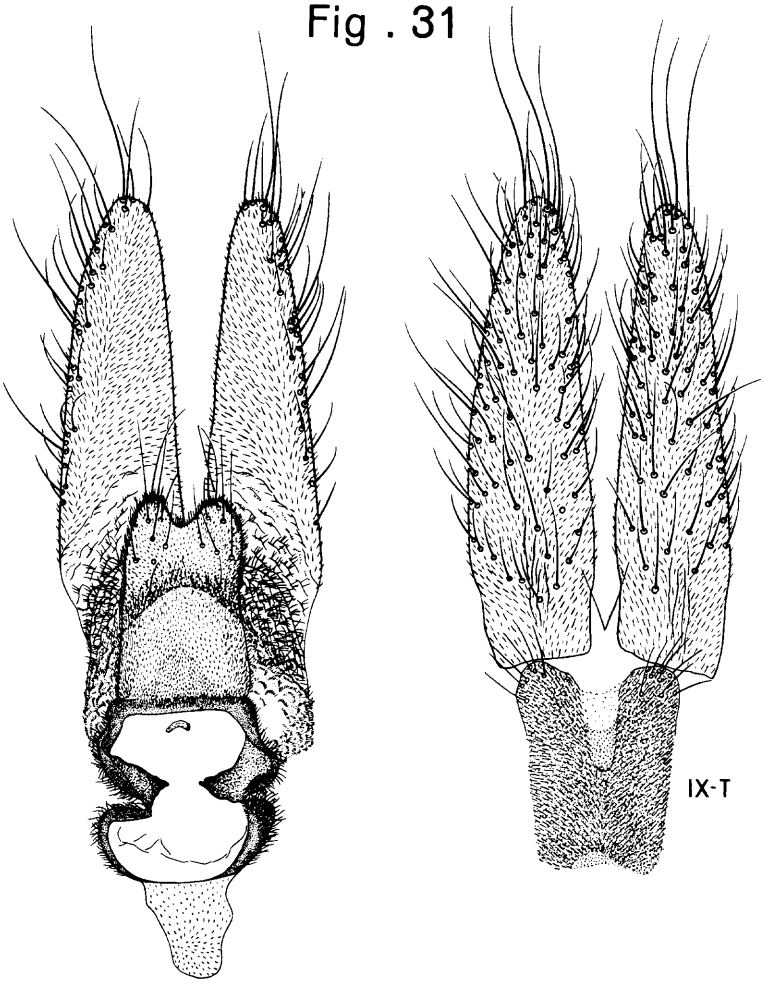
VIII-T

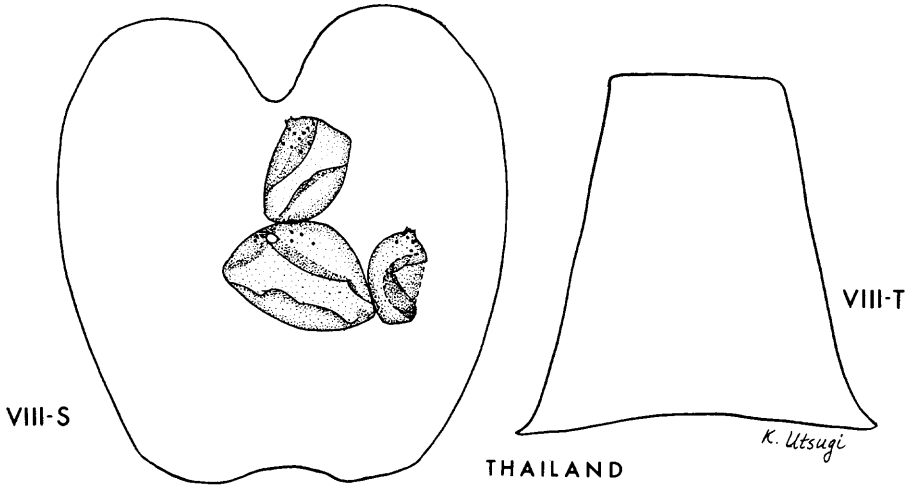
m. Hasunuma

INDIA

taeniorhynchoides

Fig . 31

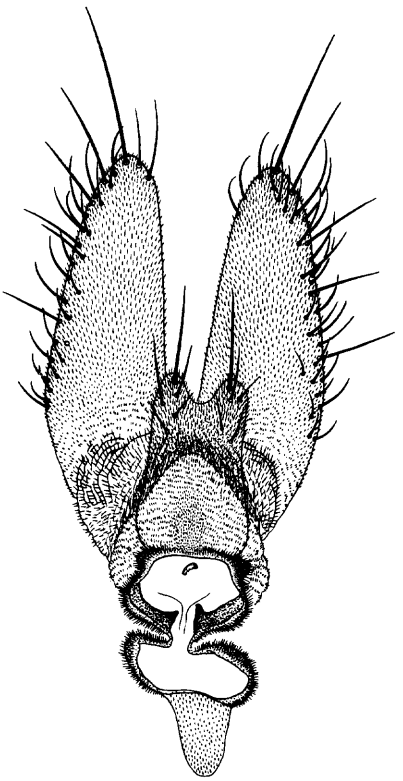


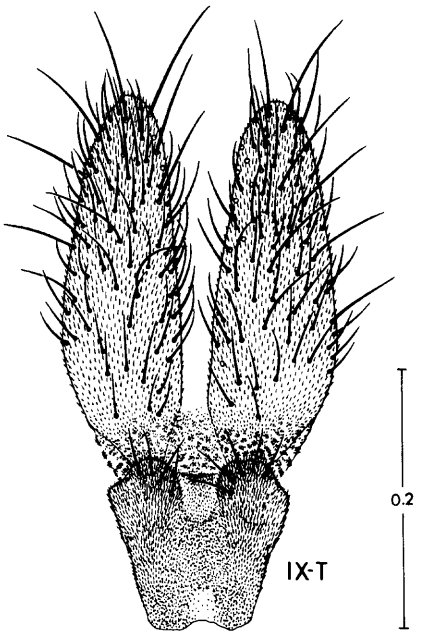


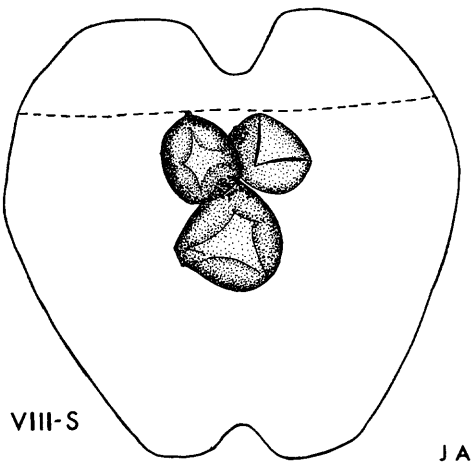
THAILAND

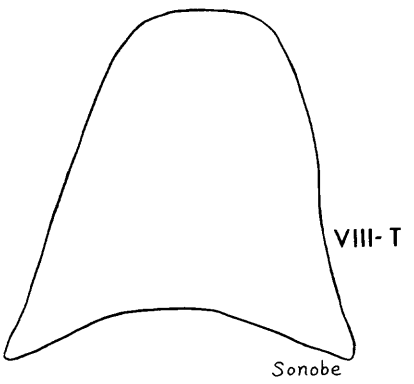
vexans vexans

Fig . 32





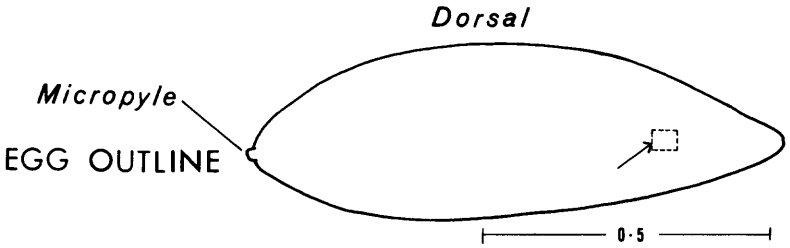




JAPAN

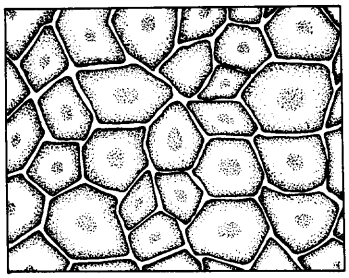
vexans nipponii

Fig. 33



CHORION RETICULATION

(enlarged from area with arrow)

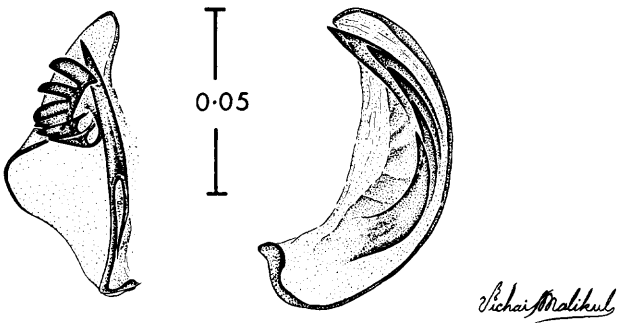


Y. Sohn

THAILAND

mediolineatus

Lateral view of aedeagus



alboscutellatus TYPE I

vexans vexans TYPE II

Fig. 34

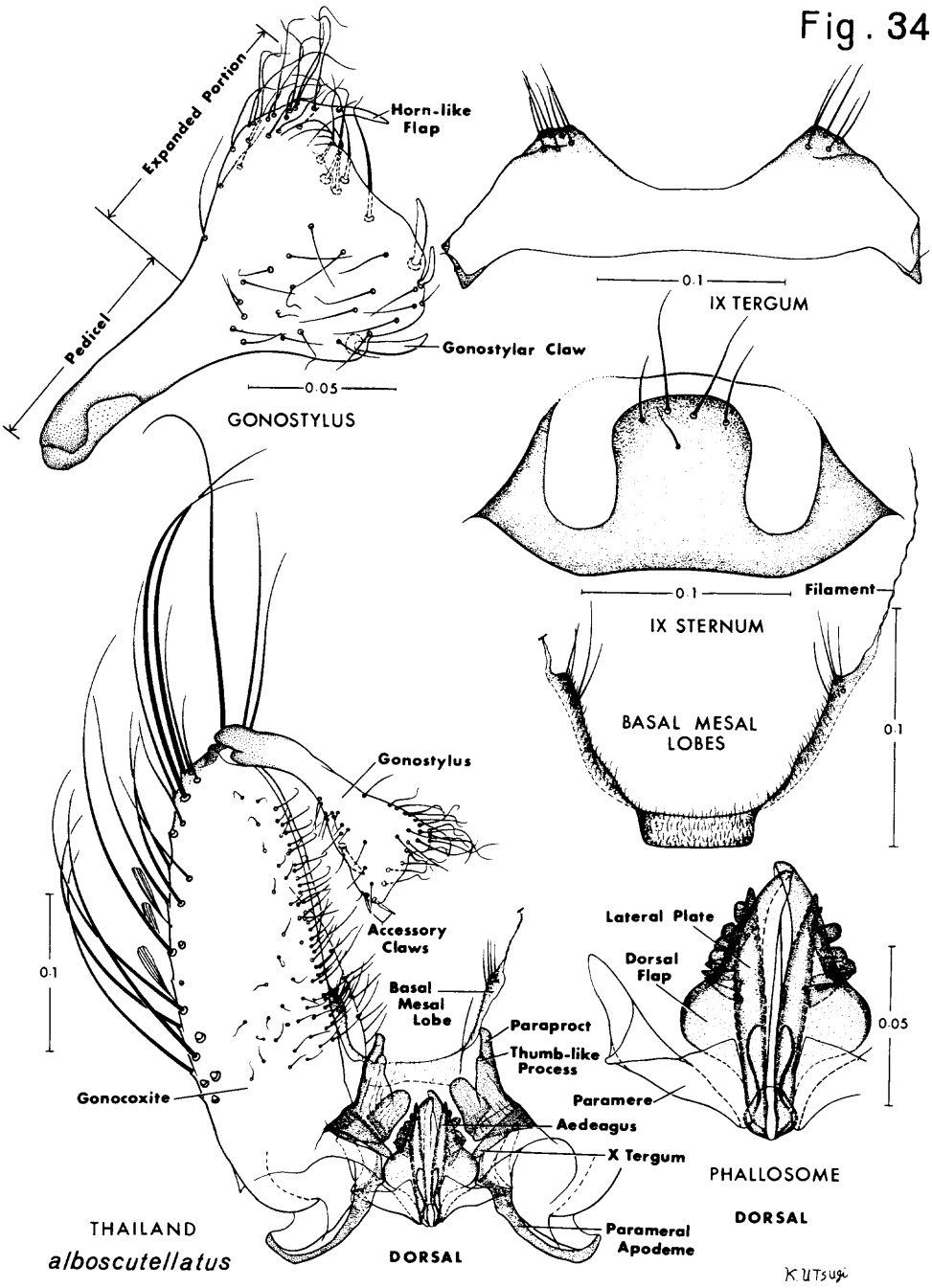

Expanded Portion
Pedicel
Horn-like Flap
Gonostylar Claw
0.05
GONOSTYLUS
0.1
IX TERGUM
0.1
Filament
IX STERNUM
BASAL MESAL LOBES
0.1
Gonostylus
Accessory Claws
Basal Mesal Lobe
Paraproct
Thumb-like Process
Gonocoxite
Aedeagus
X Tergum
Parameral Apodeme
0.1
THAILAND
alboscutellatus
DORSAL
Lateral Plate
Dorsal Flap
Paramere
0.05
PHALLOSOME
DORSAL
K. Utsugi

Fig. 35

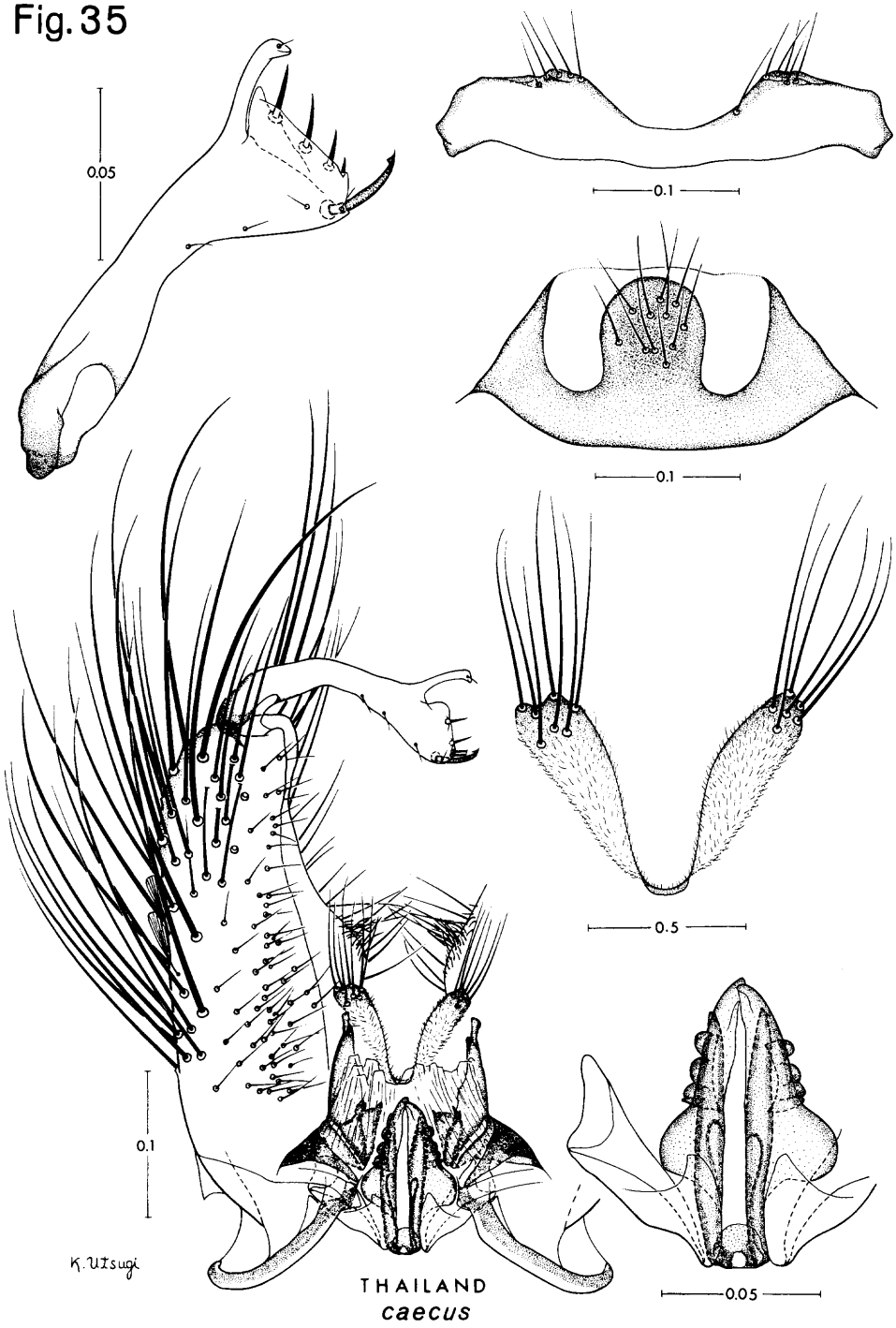


Fig. 36

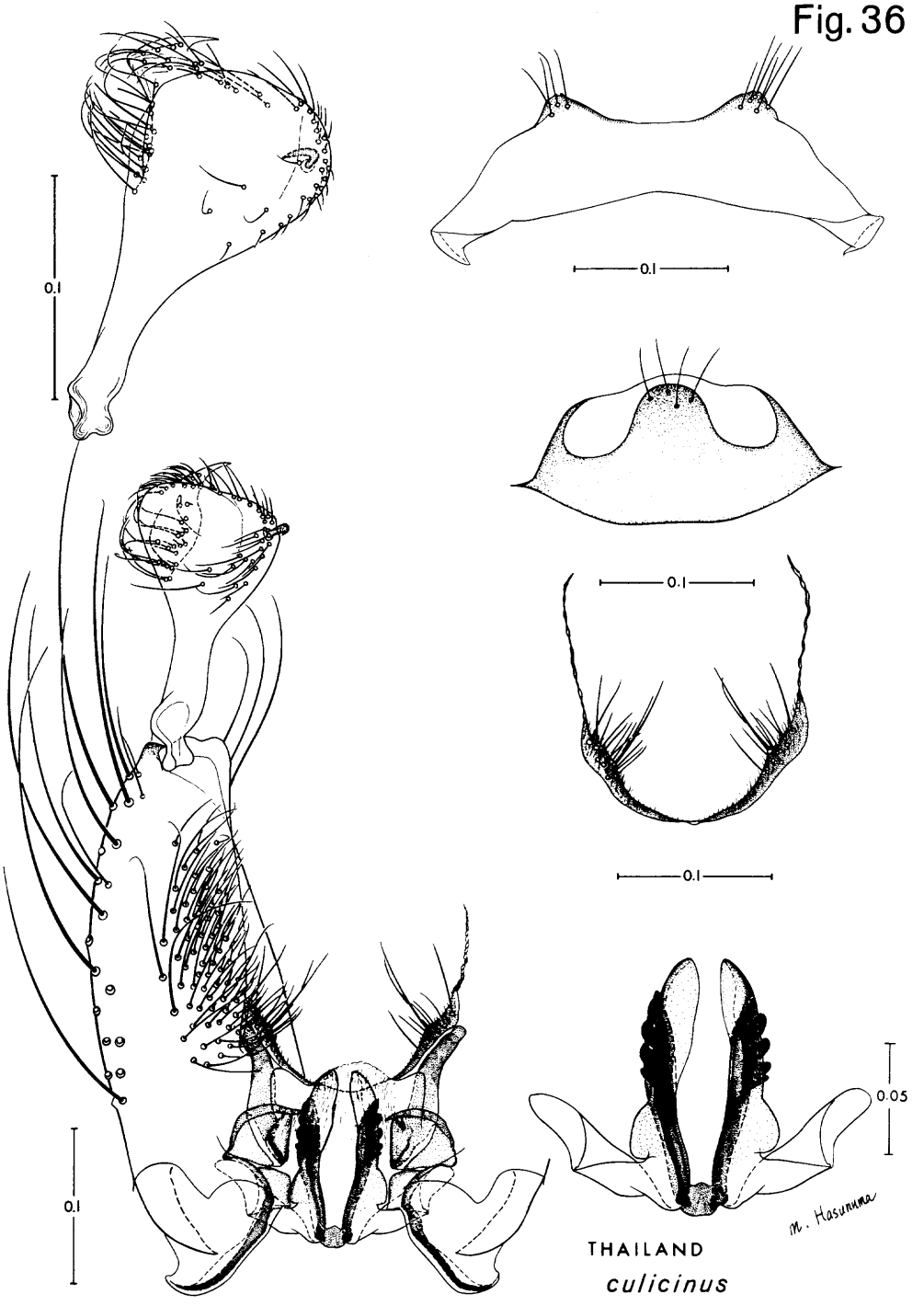


Fig. 37

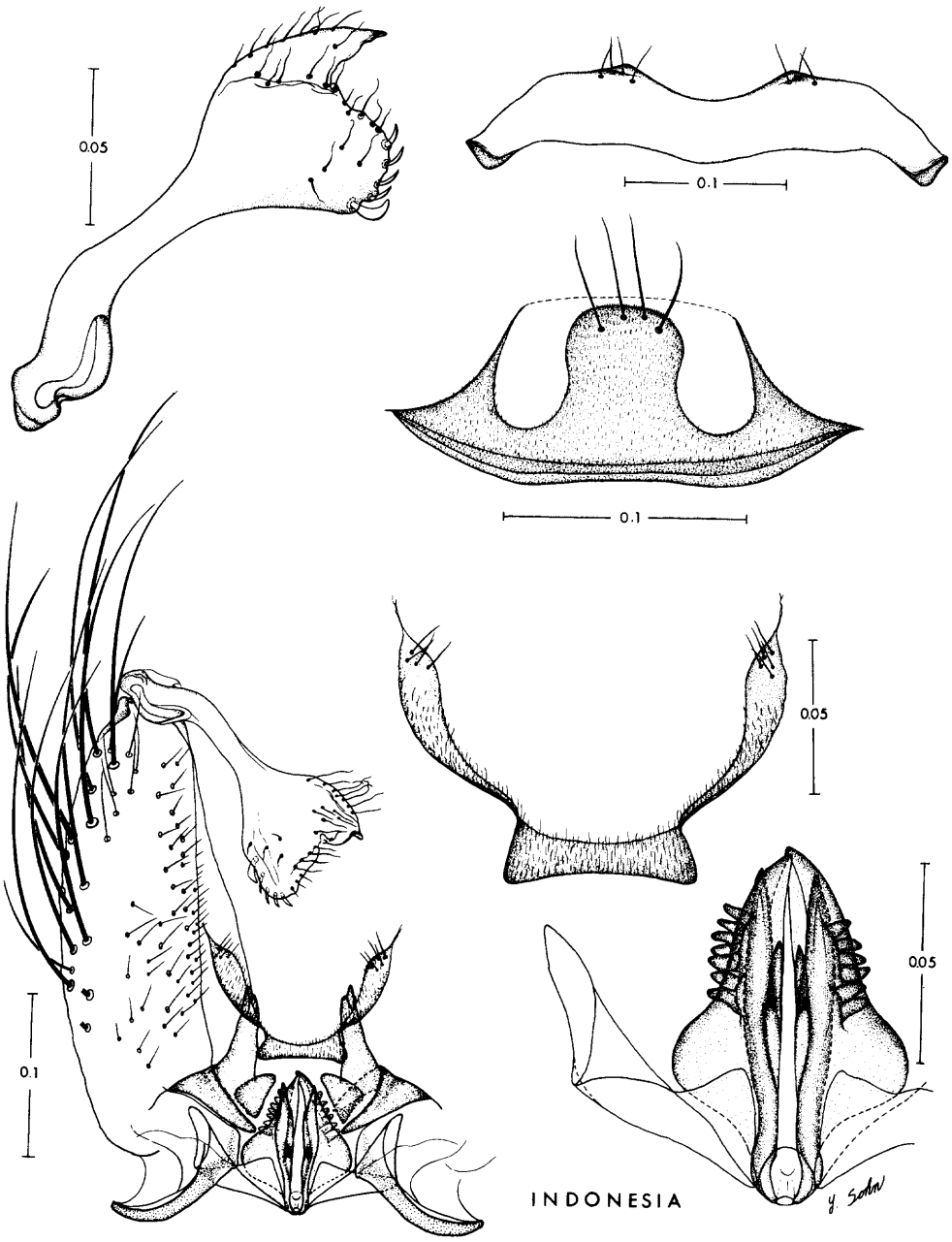
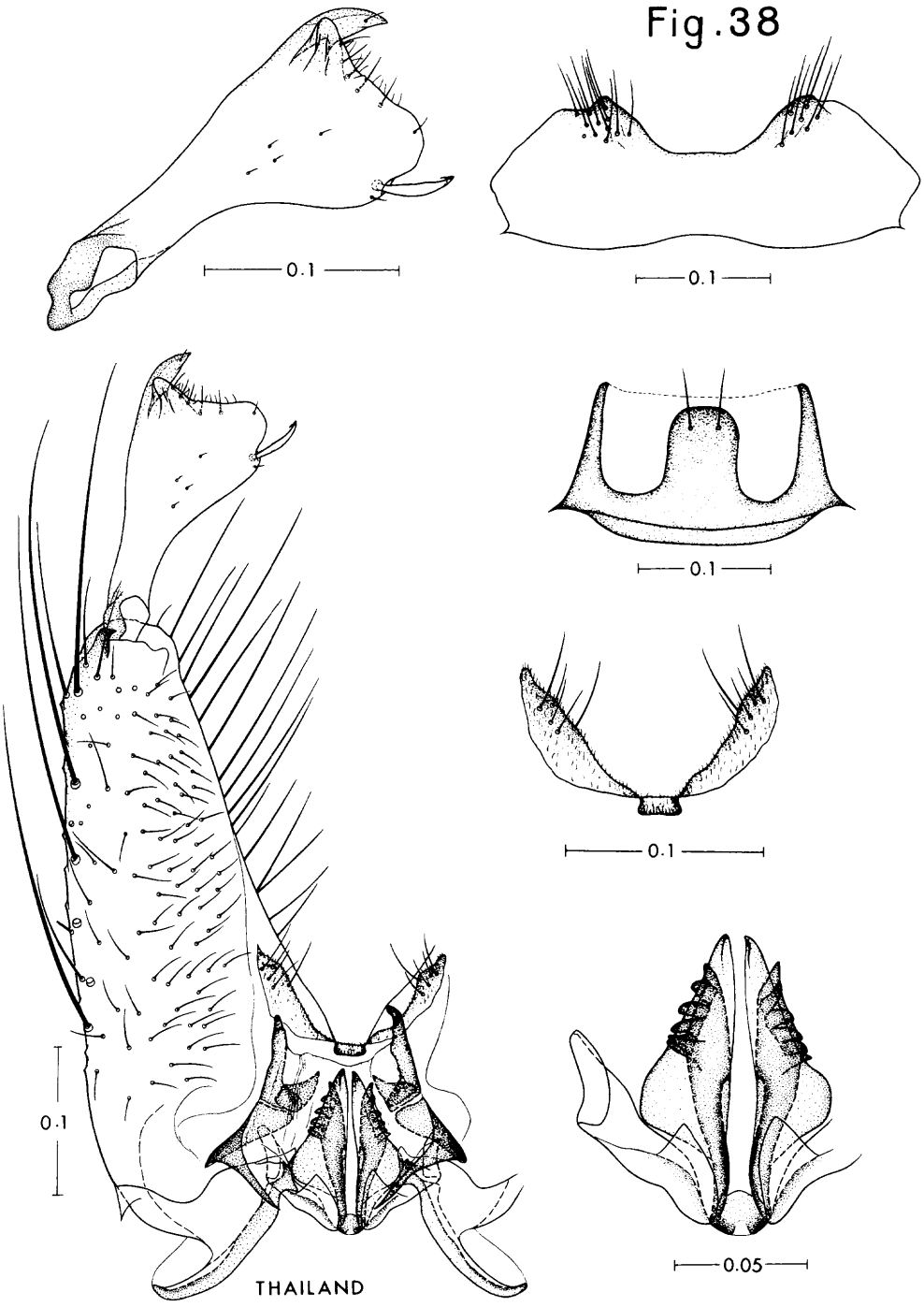


Fig.38



mediolineatus

m. misaki

Fig. 39

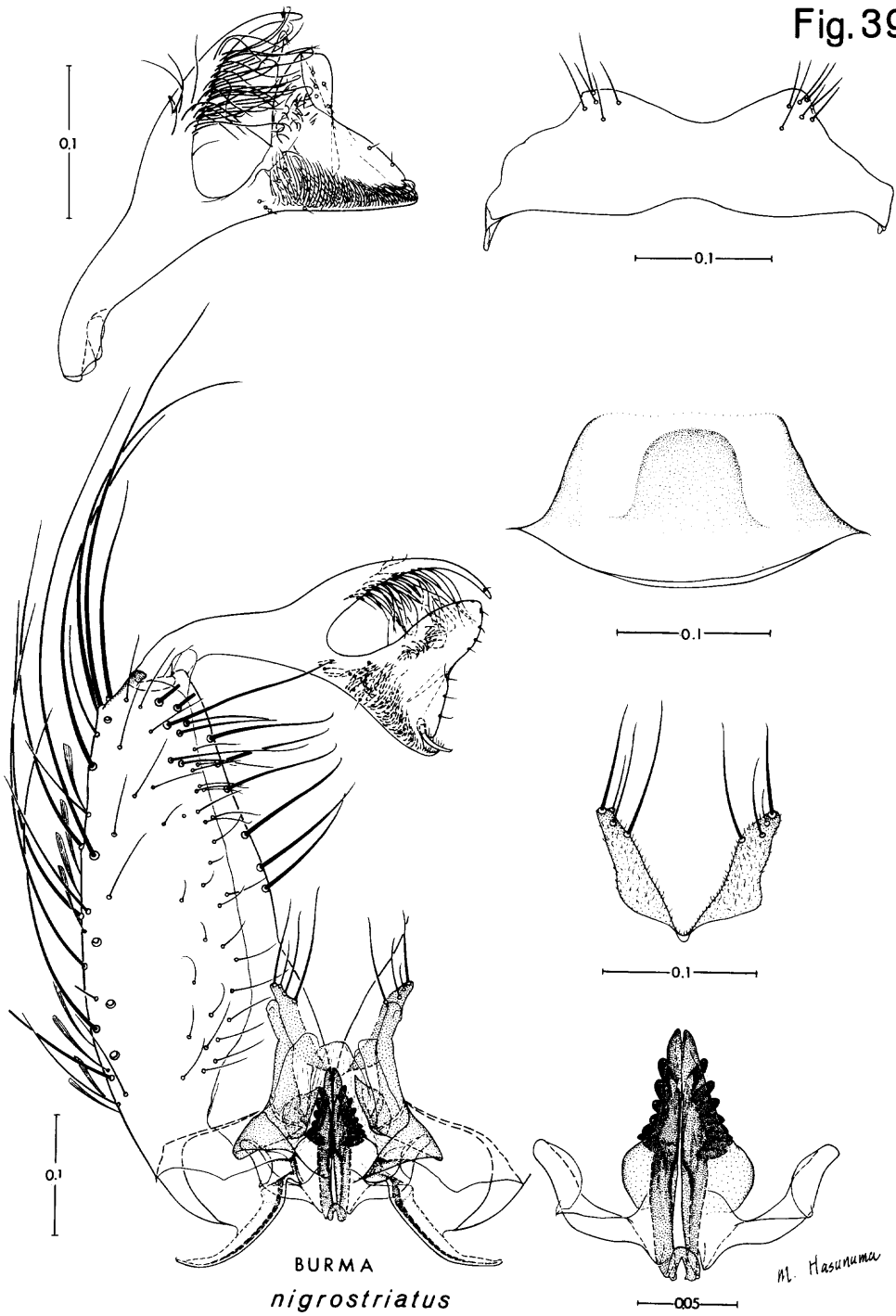
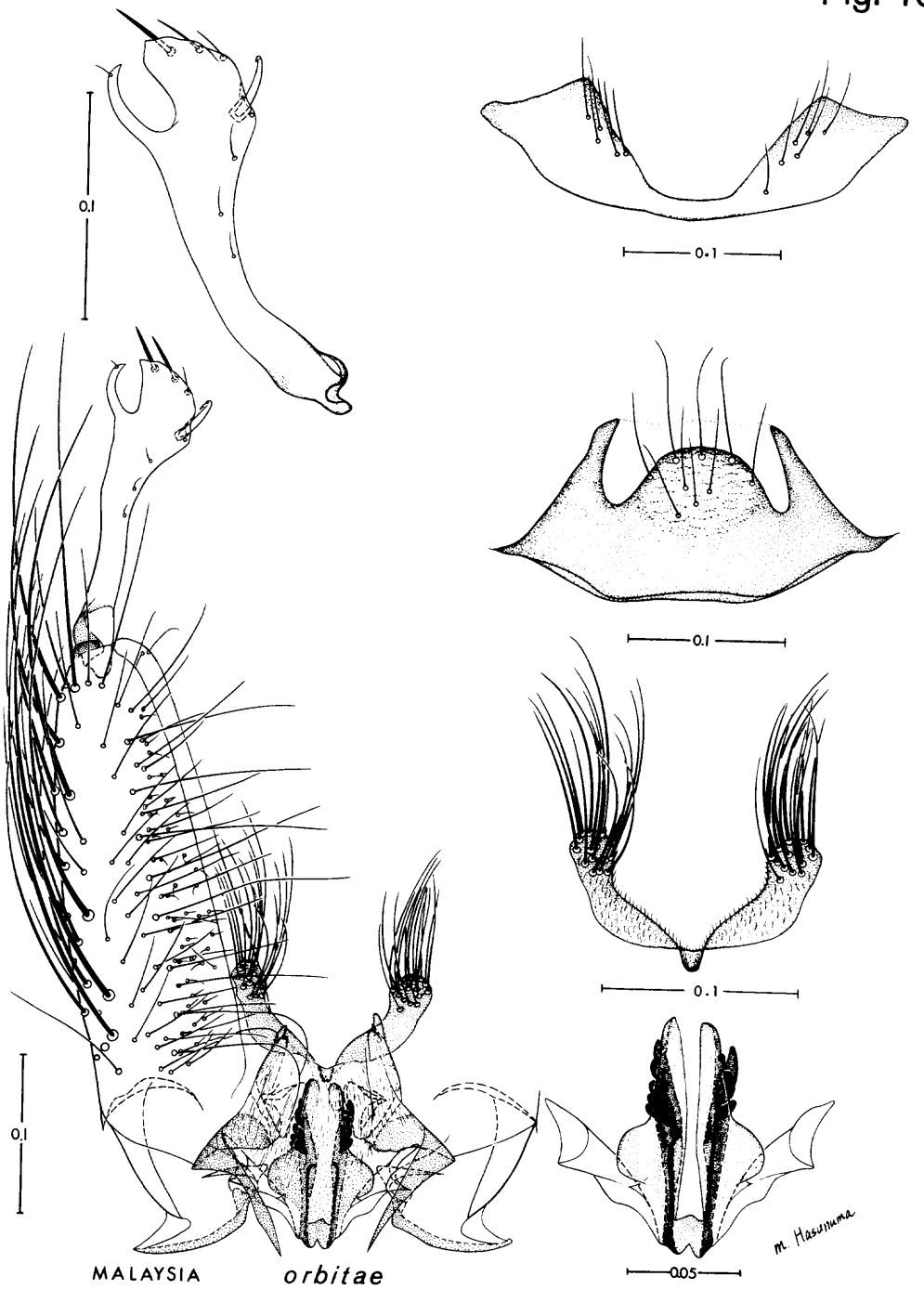


Fig. 40



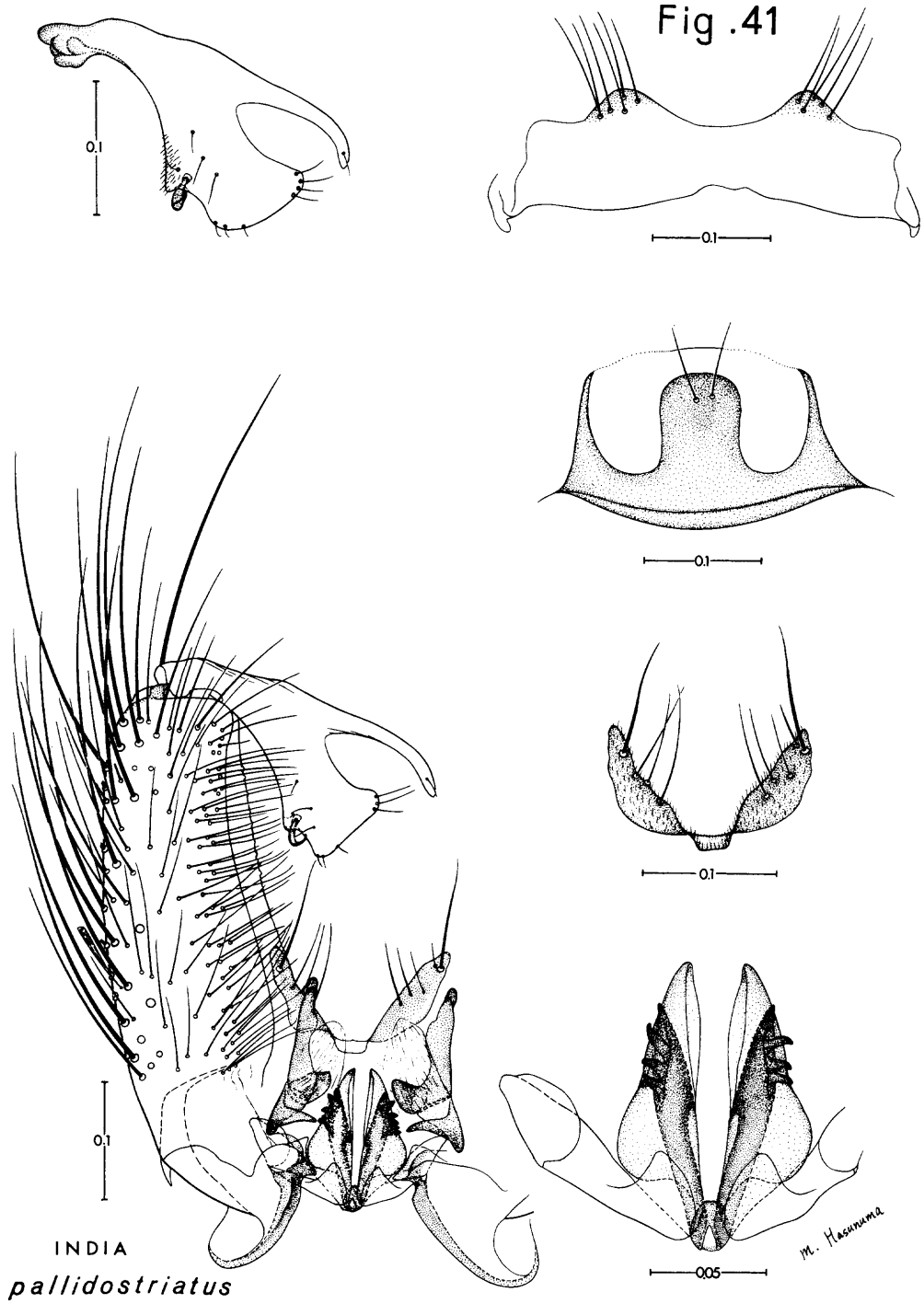
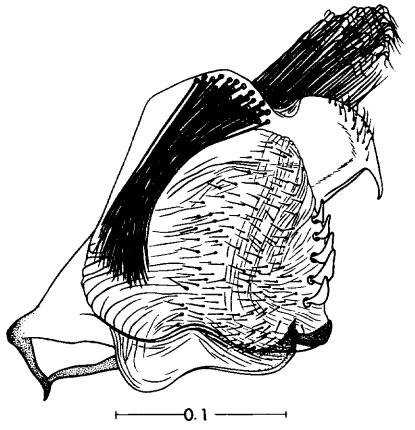
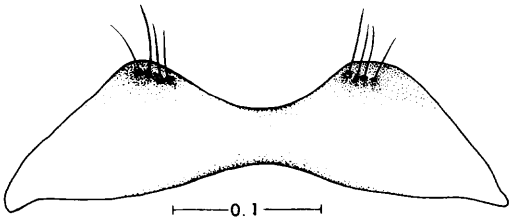
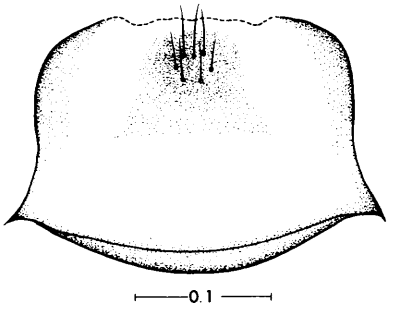


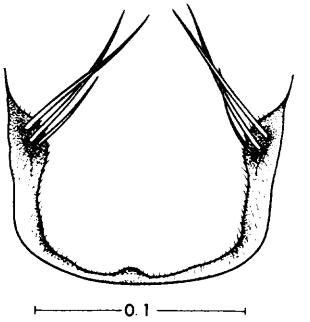
Fig .41
0.1
0.1
0.1
0.1
0.1
0.05
M. Hasunuma
INDIA
pallidostriatus

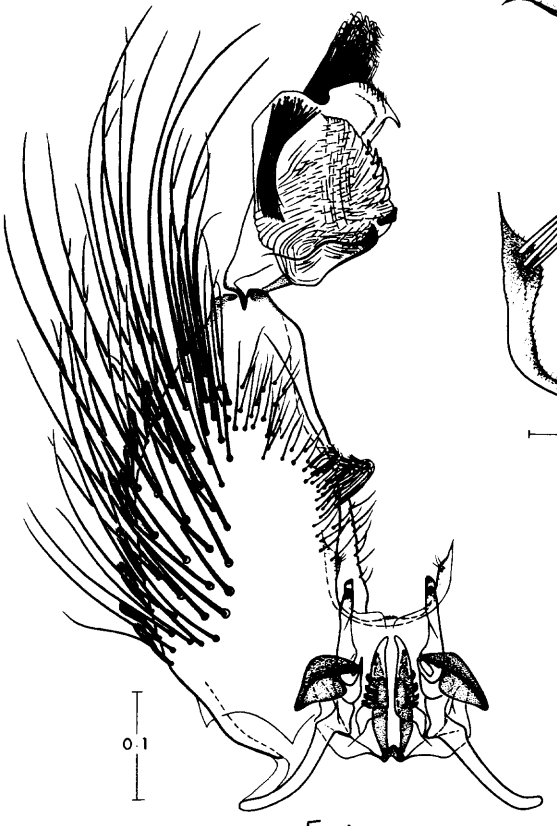
Fig. 42

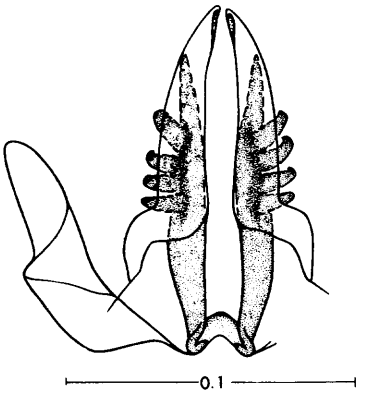










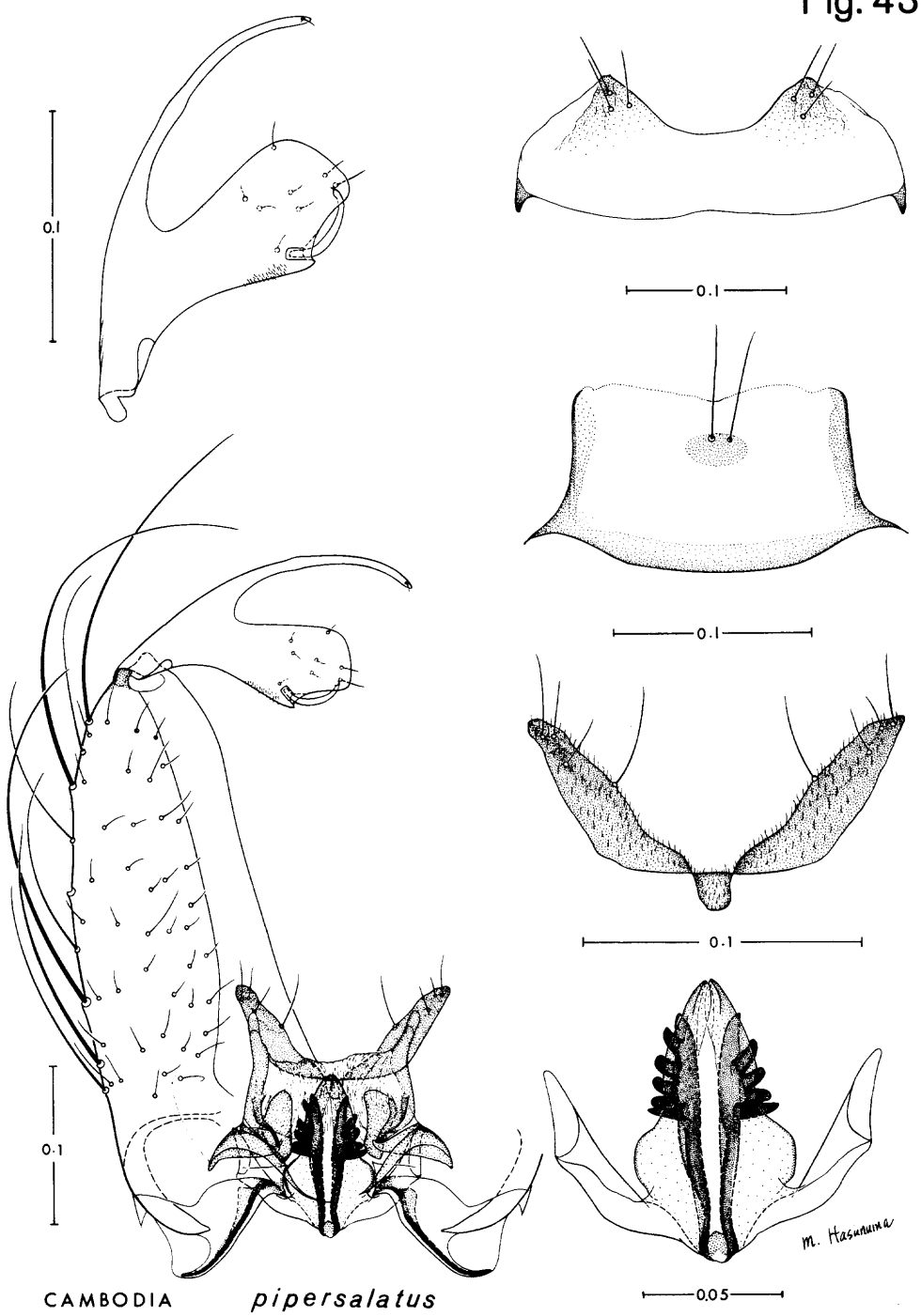


PHILIPPINES

pampangensis

Fujisawa

Fig. 43



CAMBODIA *pipersalatus*

Fig. 44

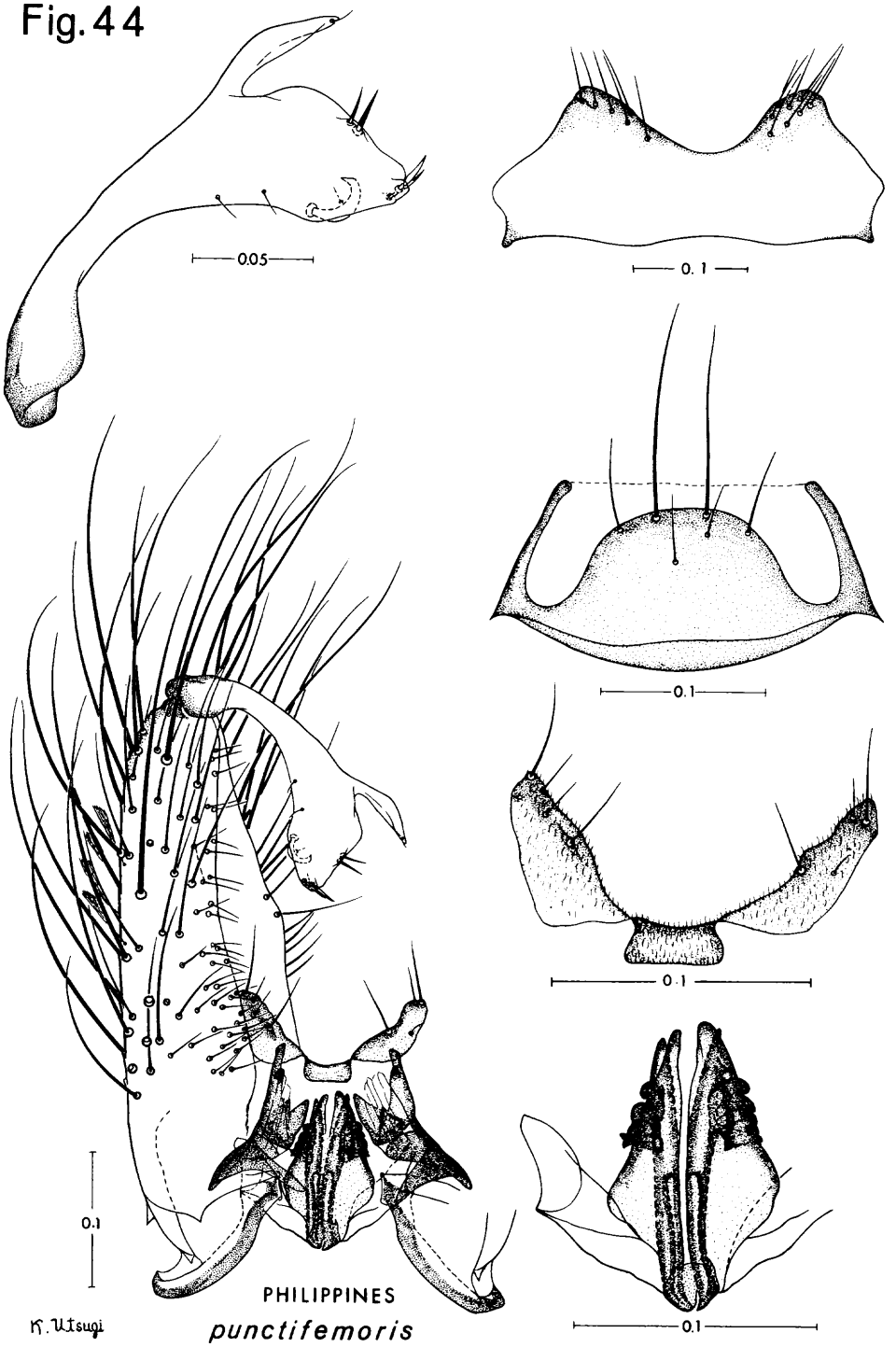


Fig. 45

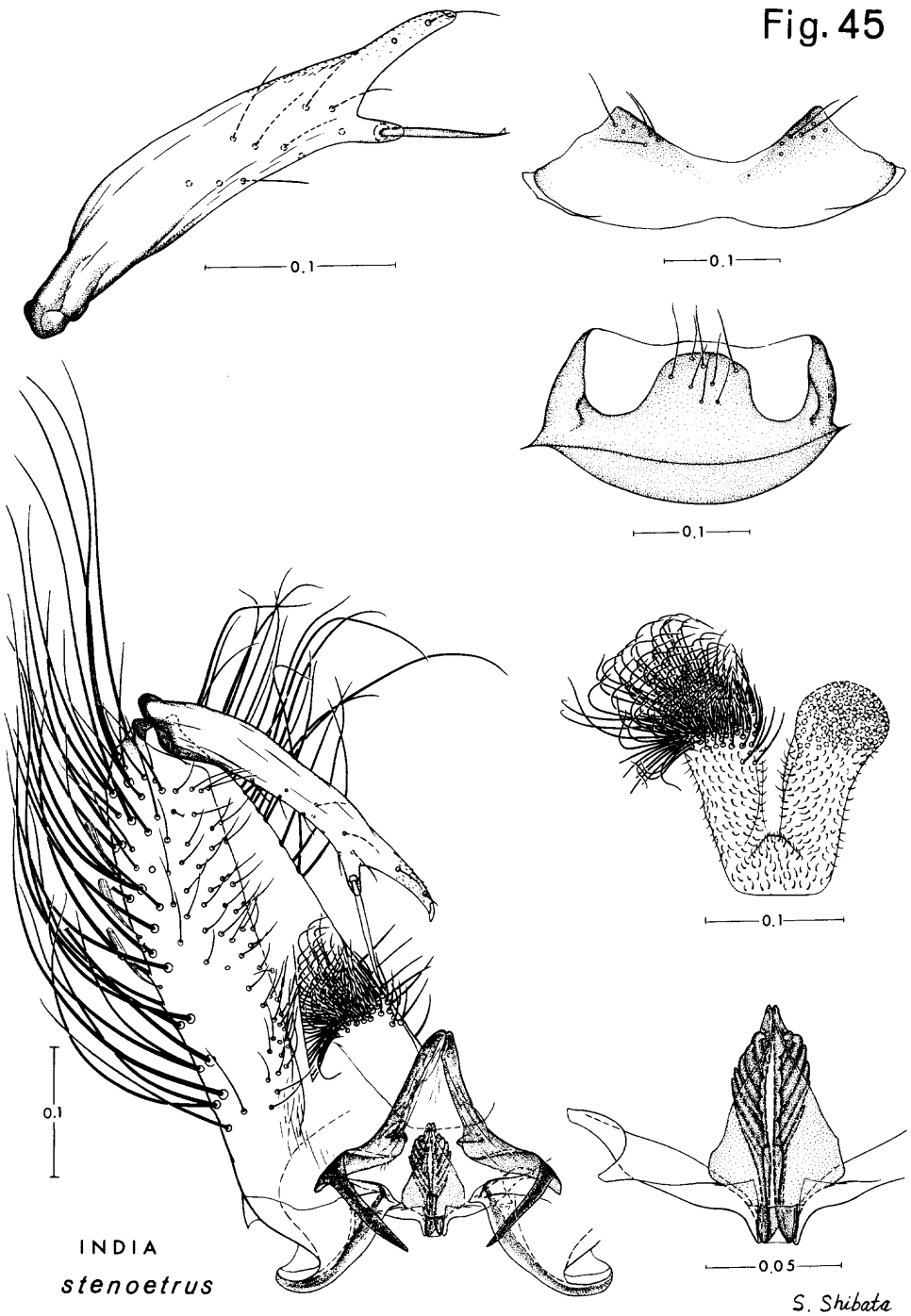
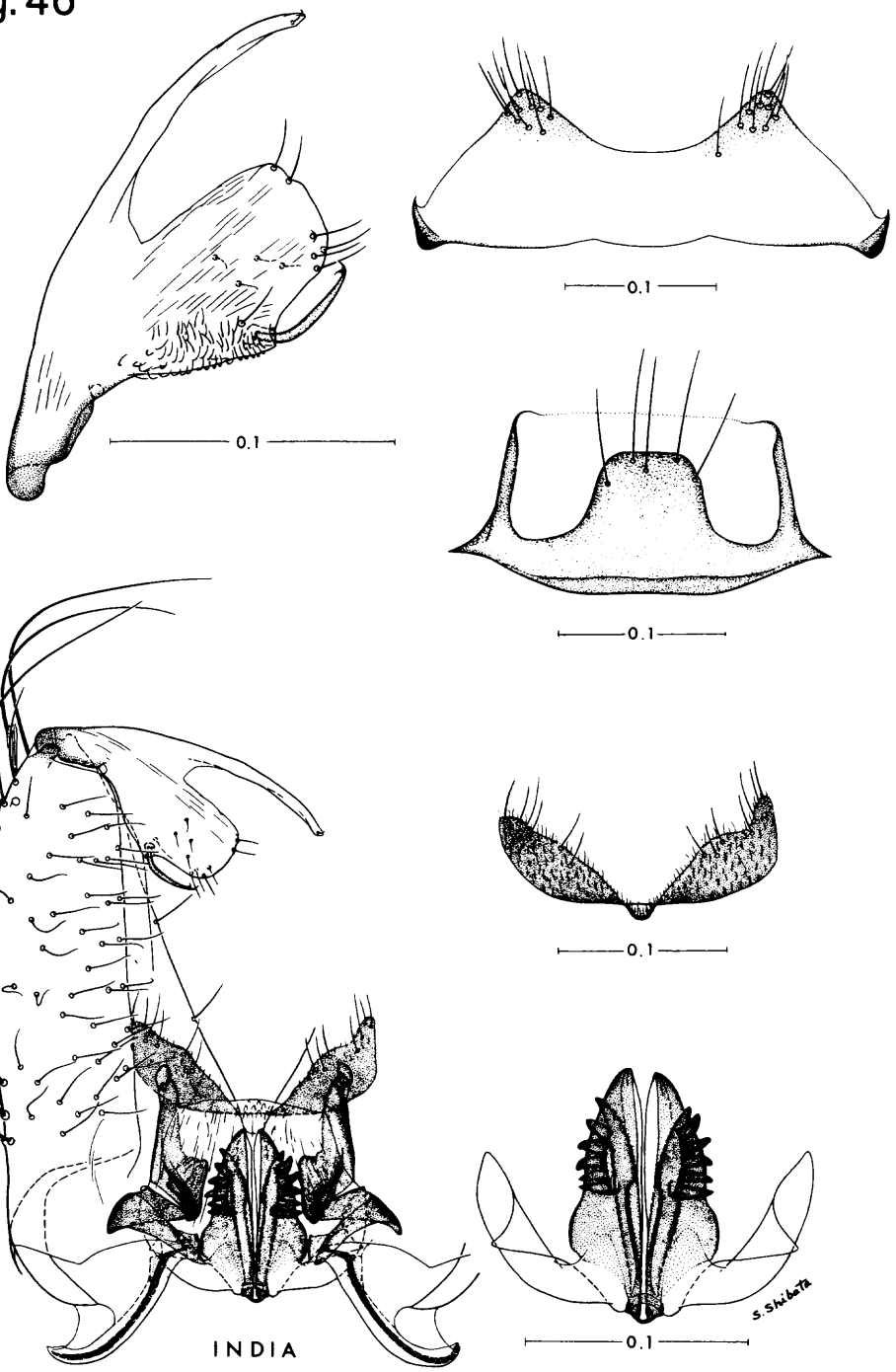
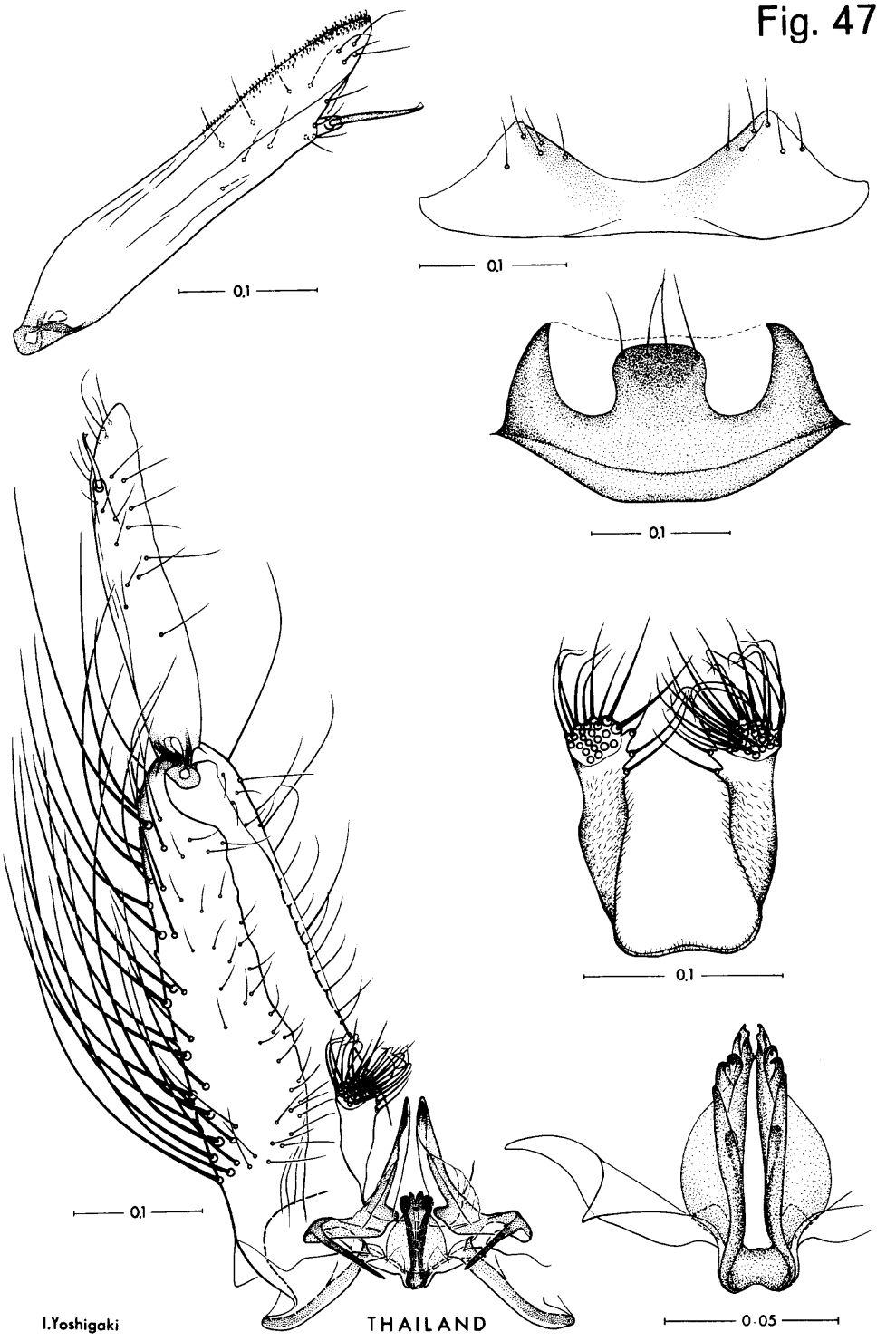


Fig. 46



taeniorhynchoides

Fig. 47

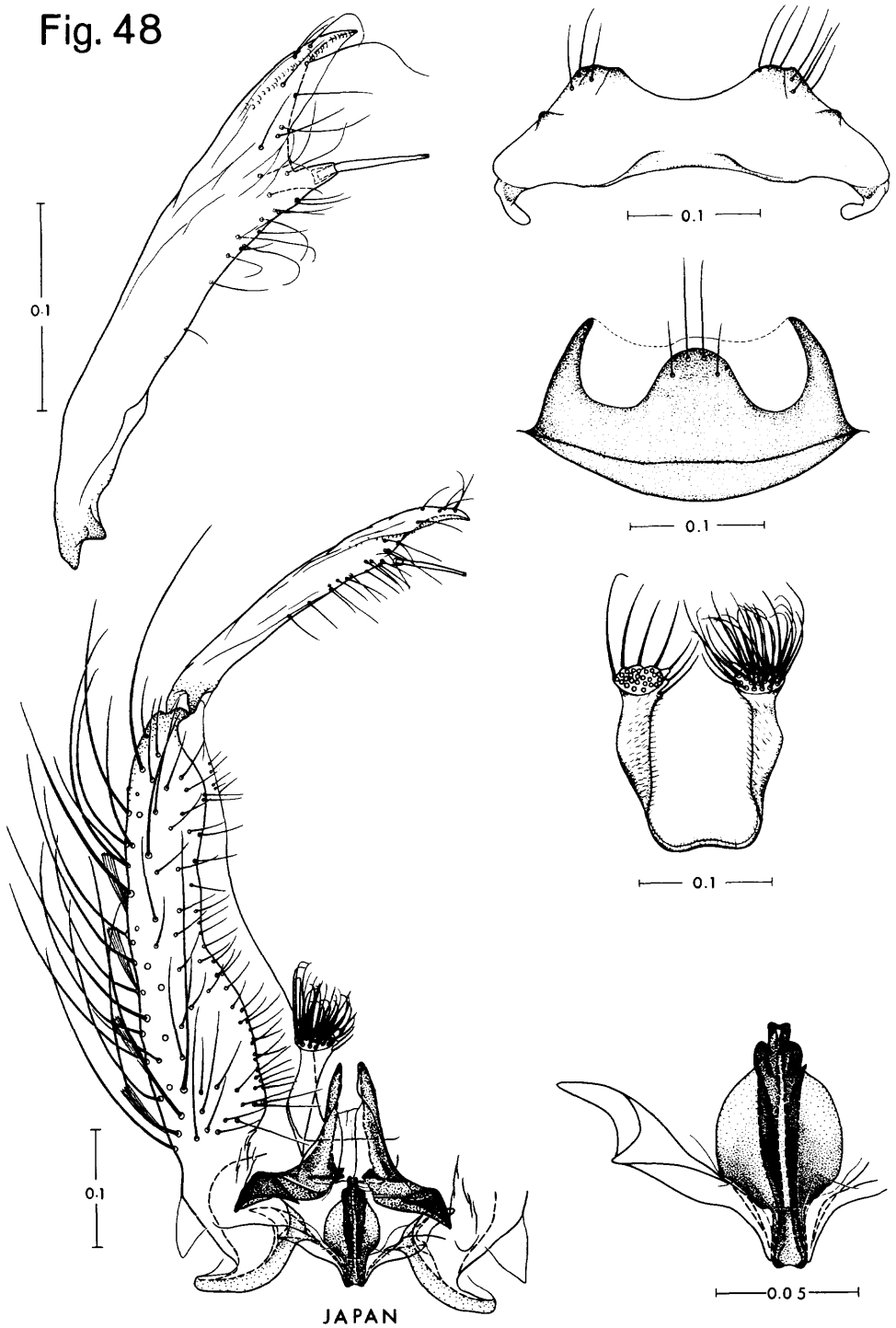


I.Yoshigaki

THAILAND

vexans vexans

Fig. 48

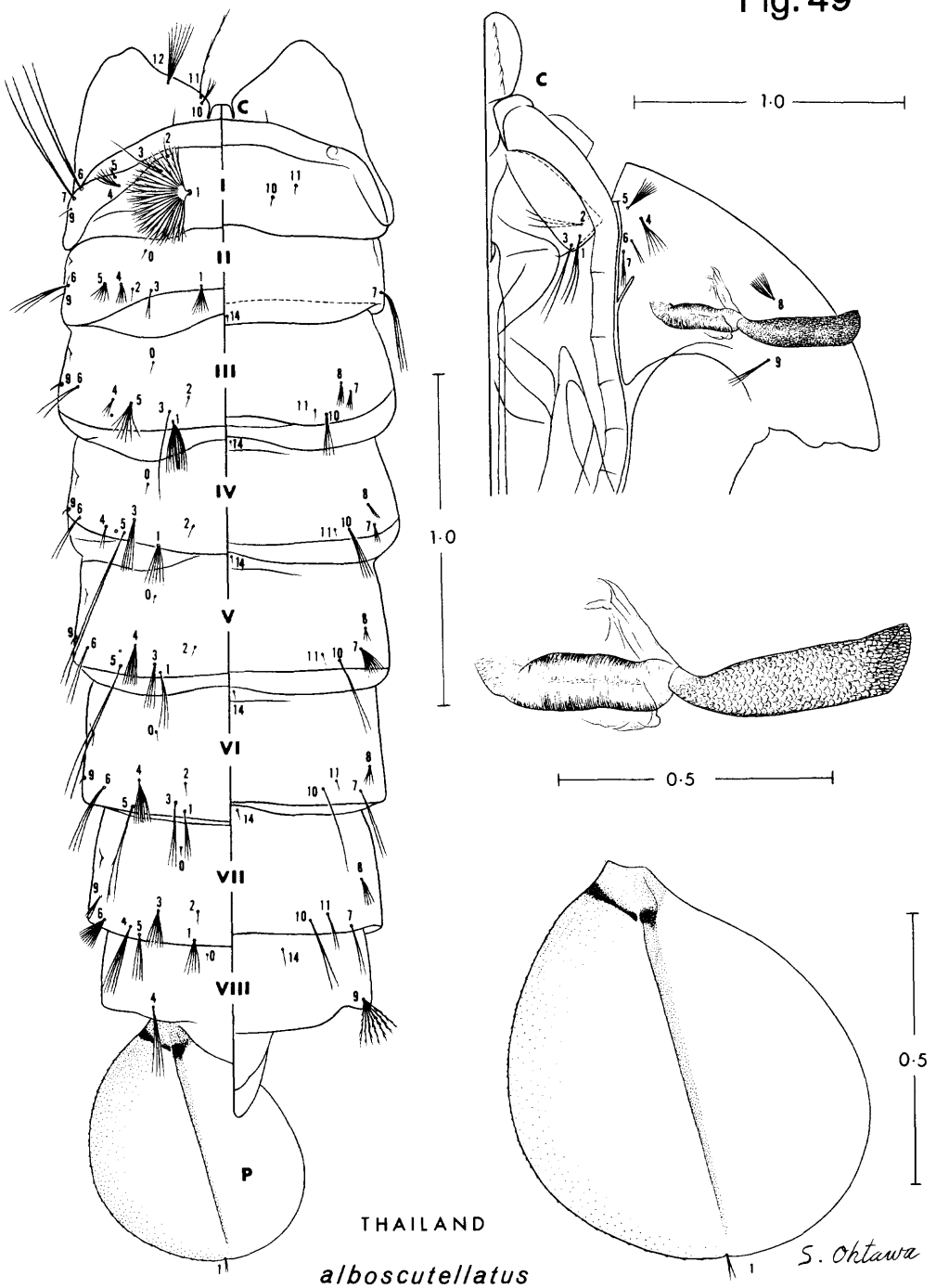


JAPAN

vexans nipponii

m. misaki

Fig. 49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VII
VIII
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0·5
THAILAND
alboscutellatus
S. Ohtawa

Fig. 50

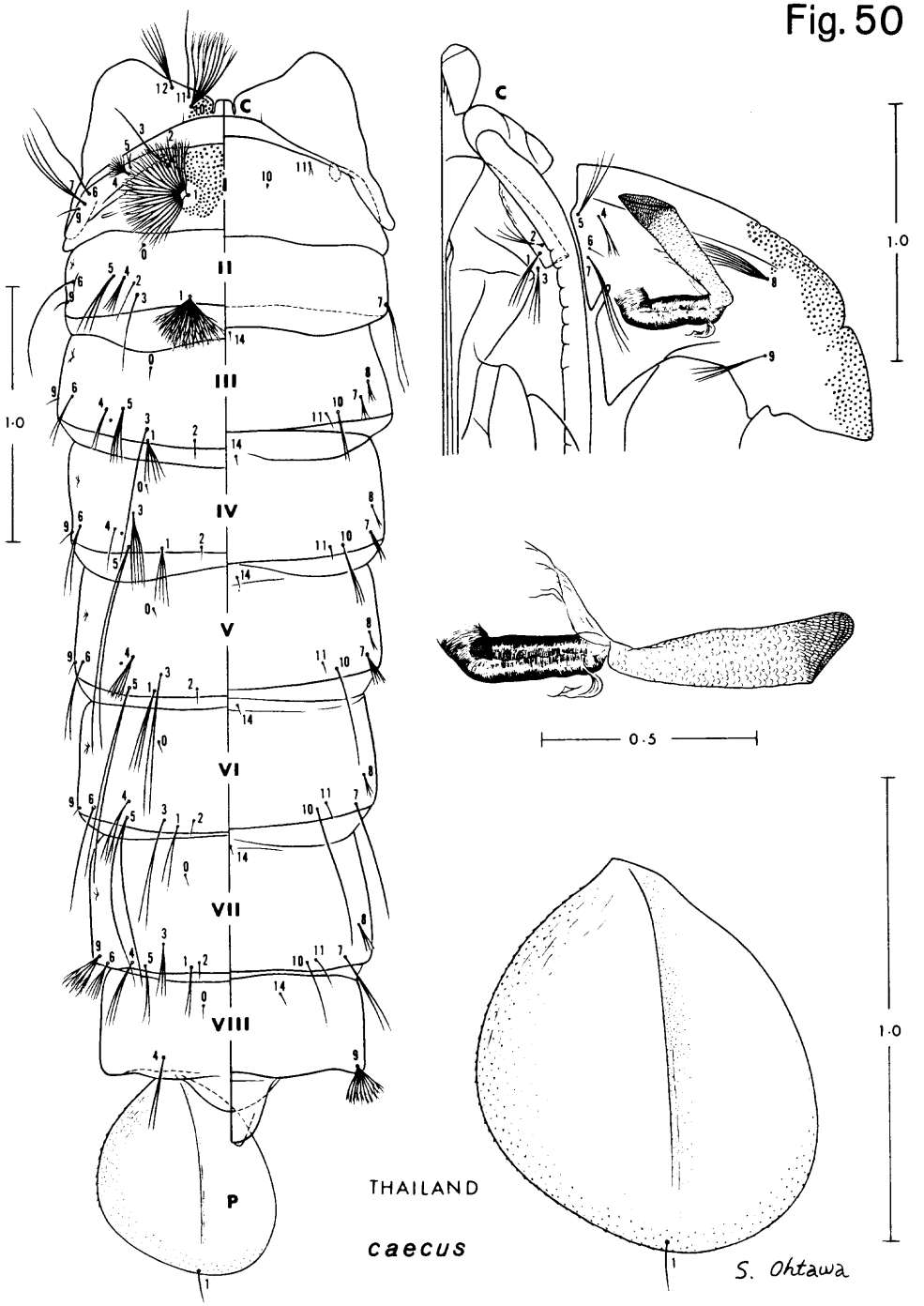
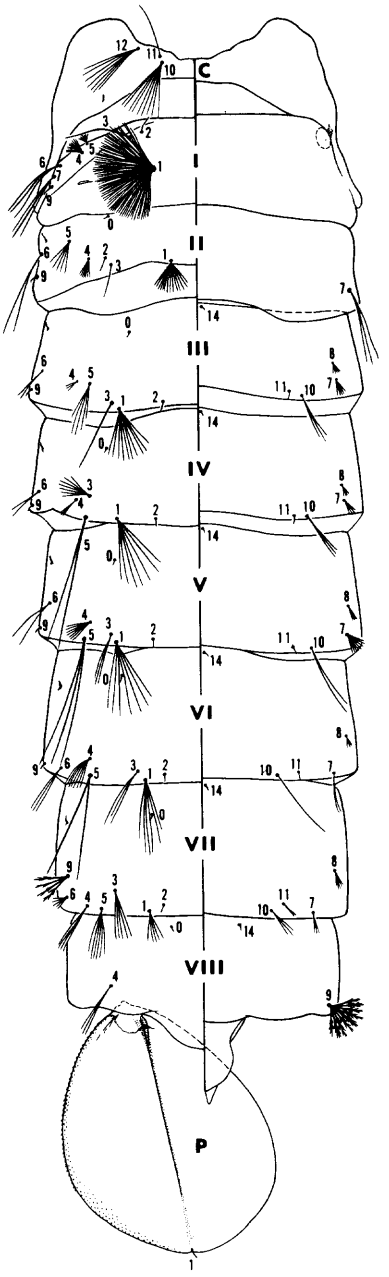
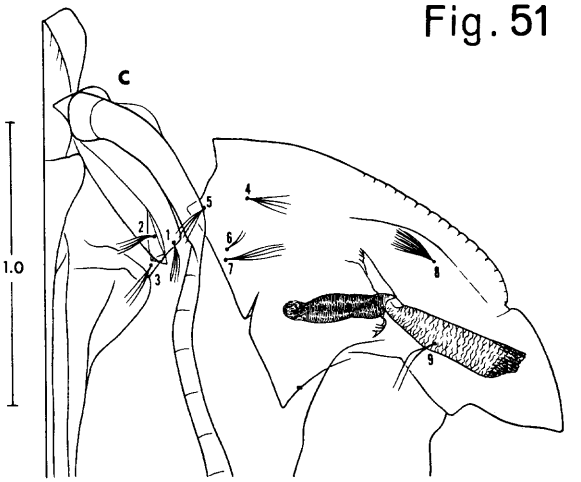


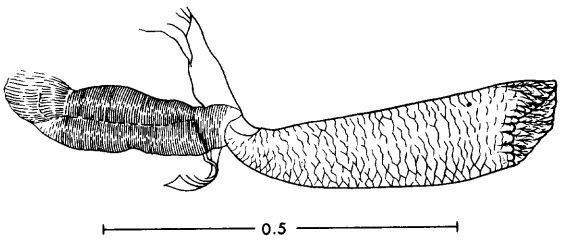
Fig. 51



THAILAND

culicinus





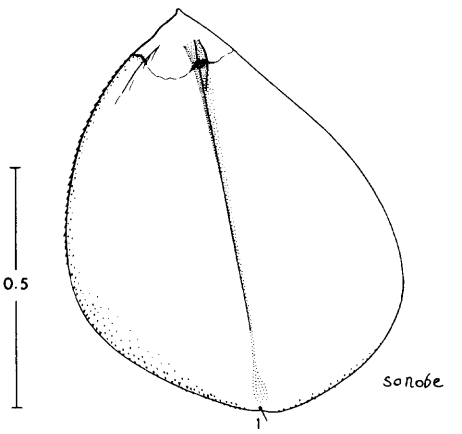
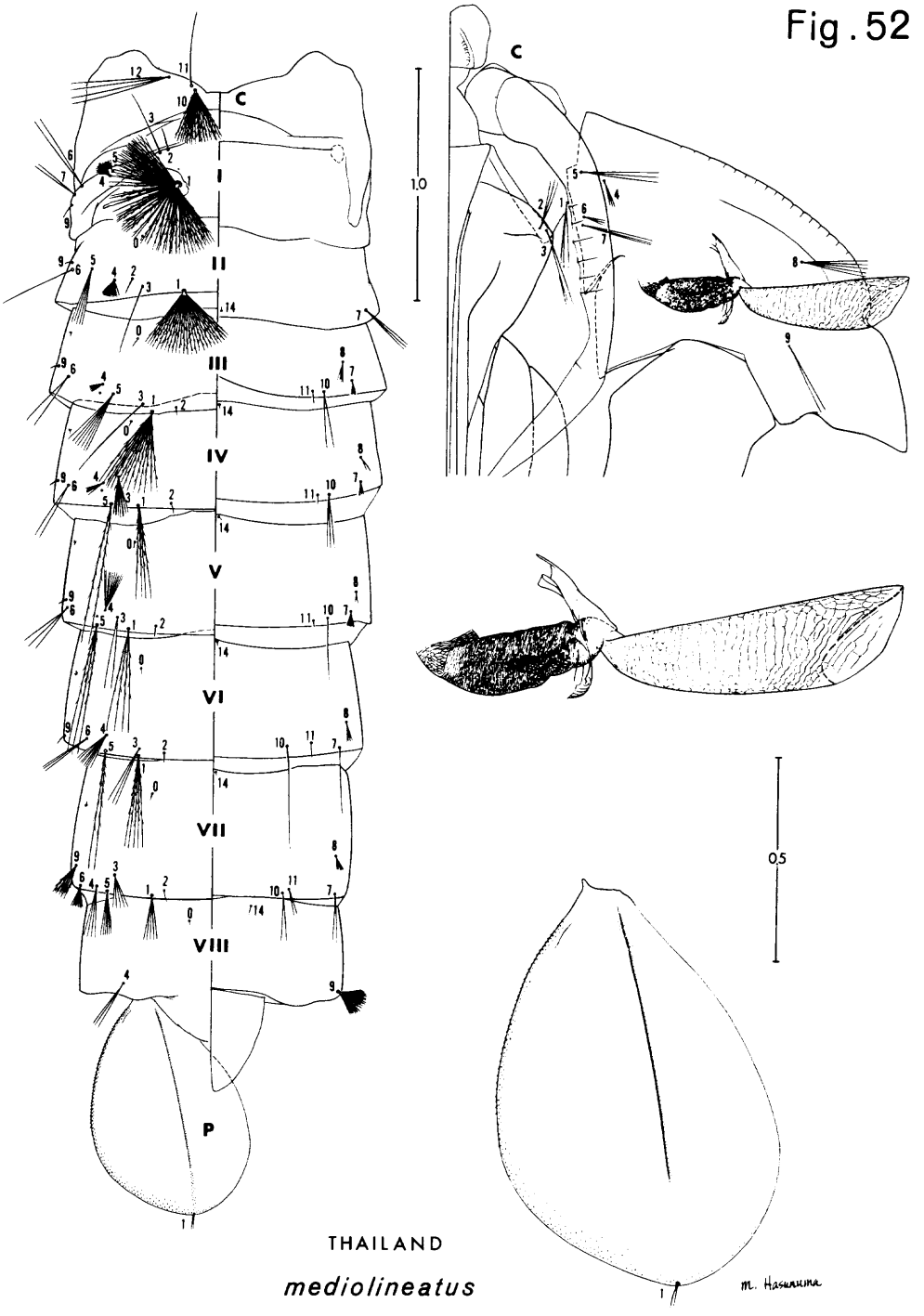


Fig. 52



THAILAND

mediolineatus

M. Hasegawa

Fig. 53

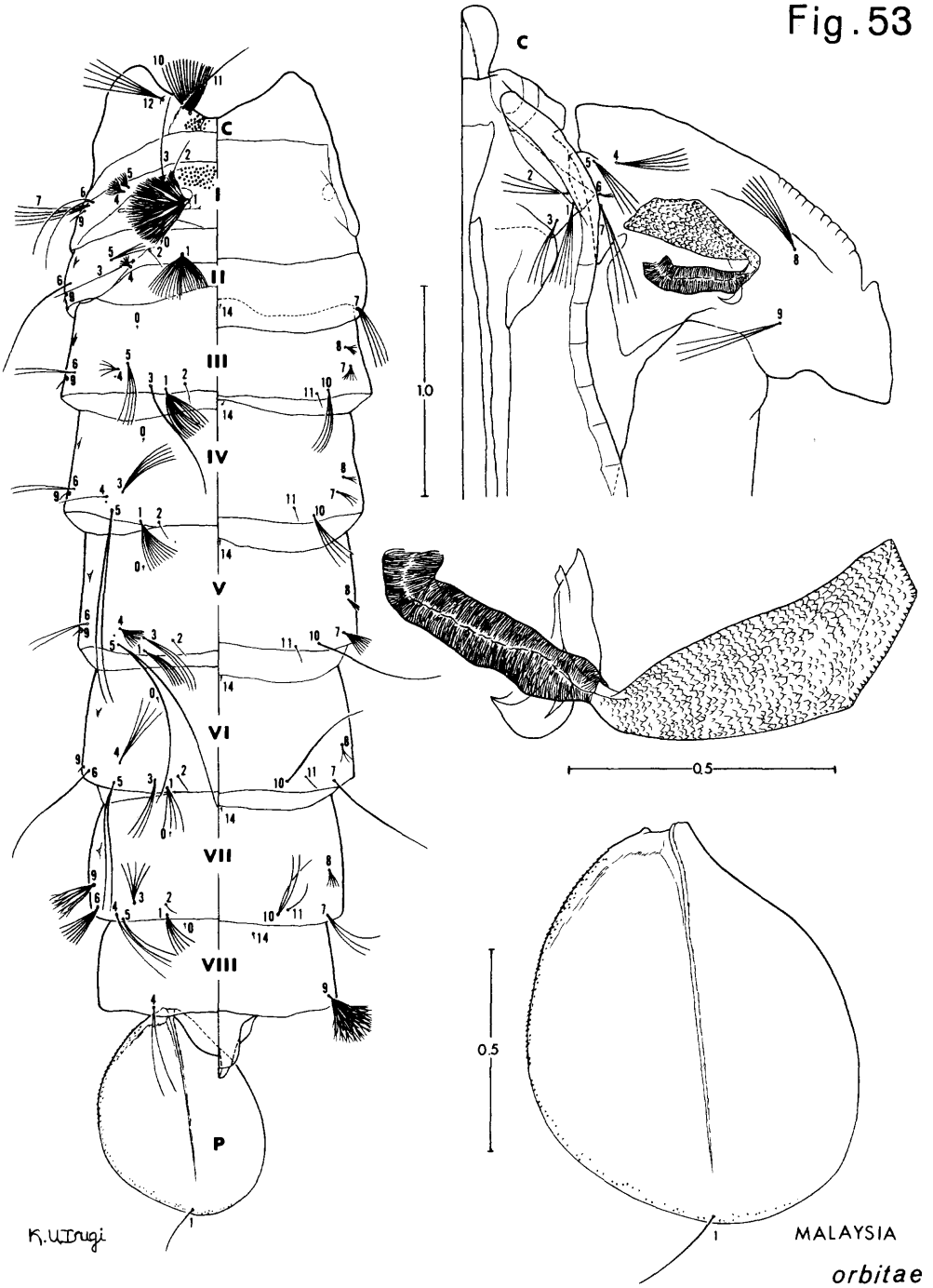
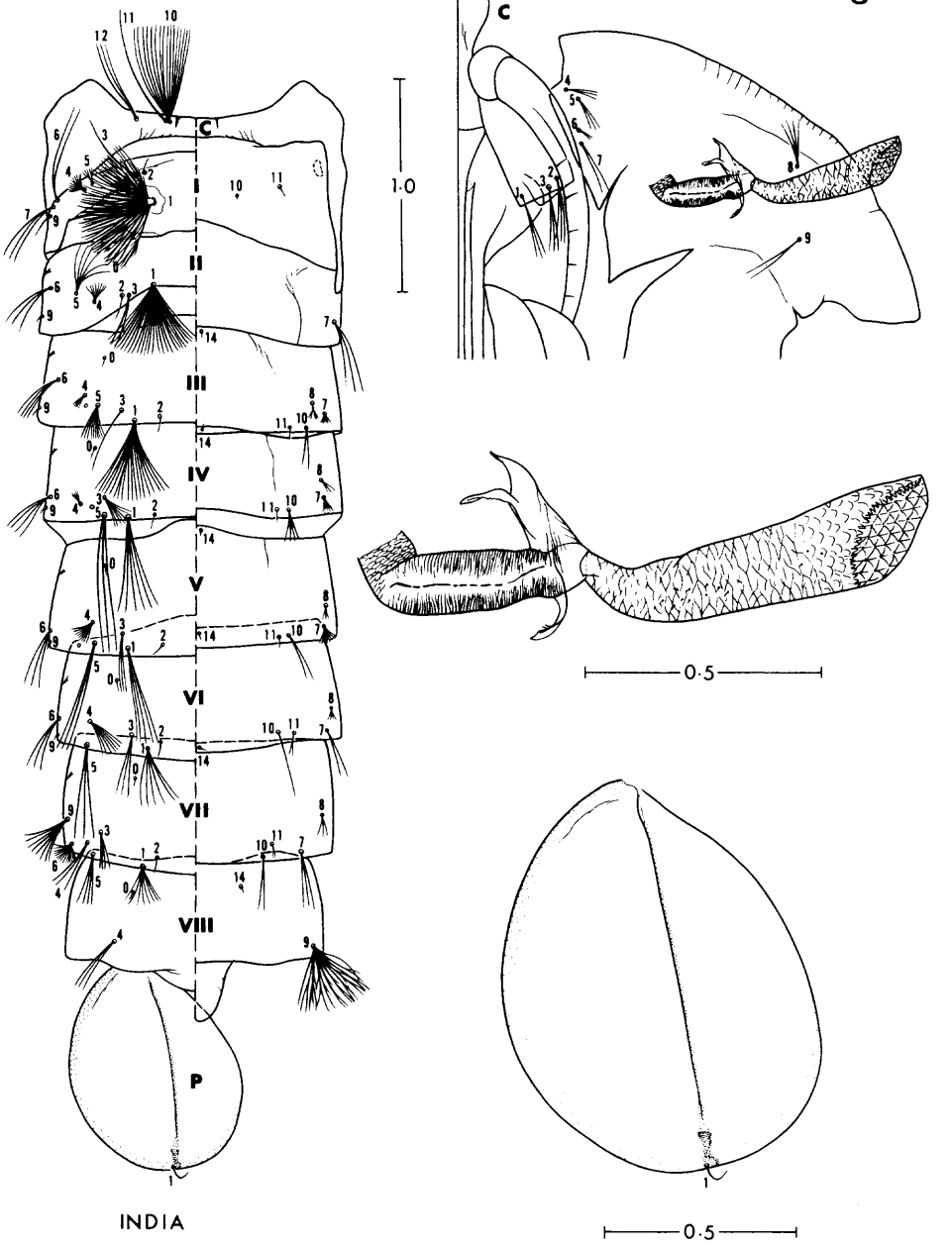


Fig. 54

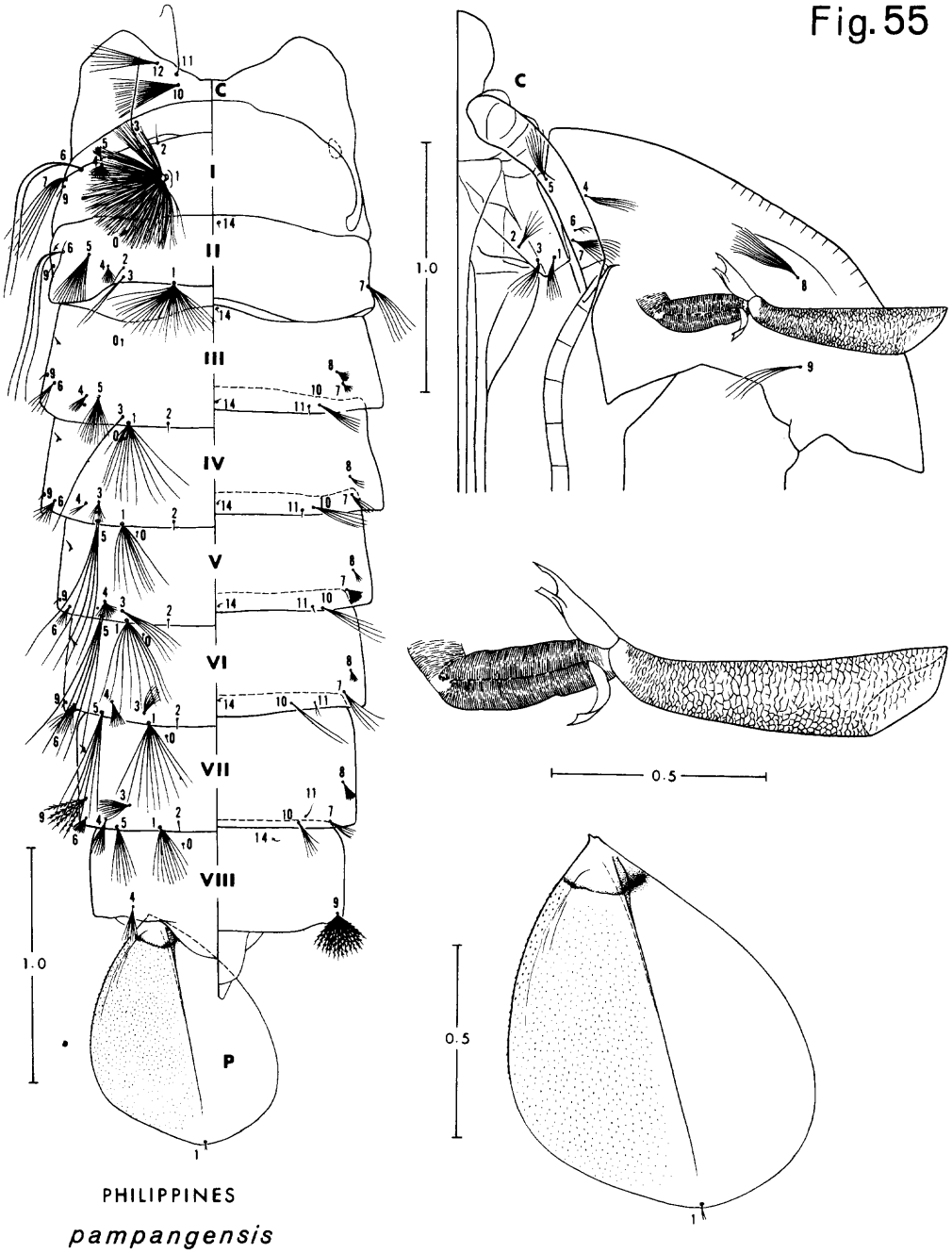


INDIA

pallidostriatus

M. Misaki

Fig. 55

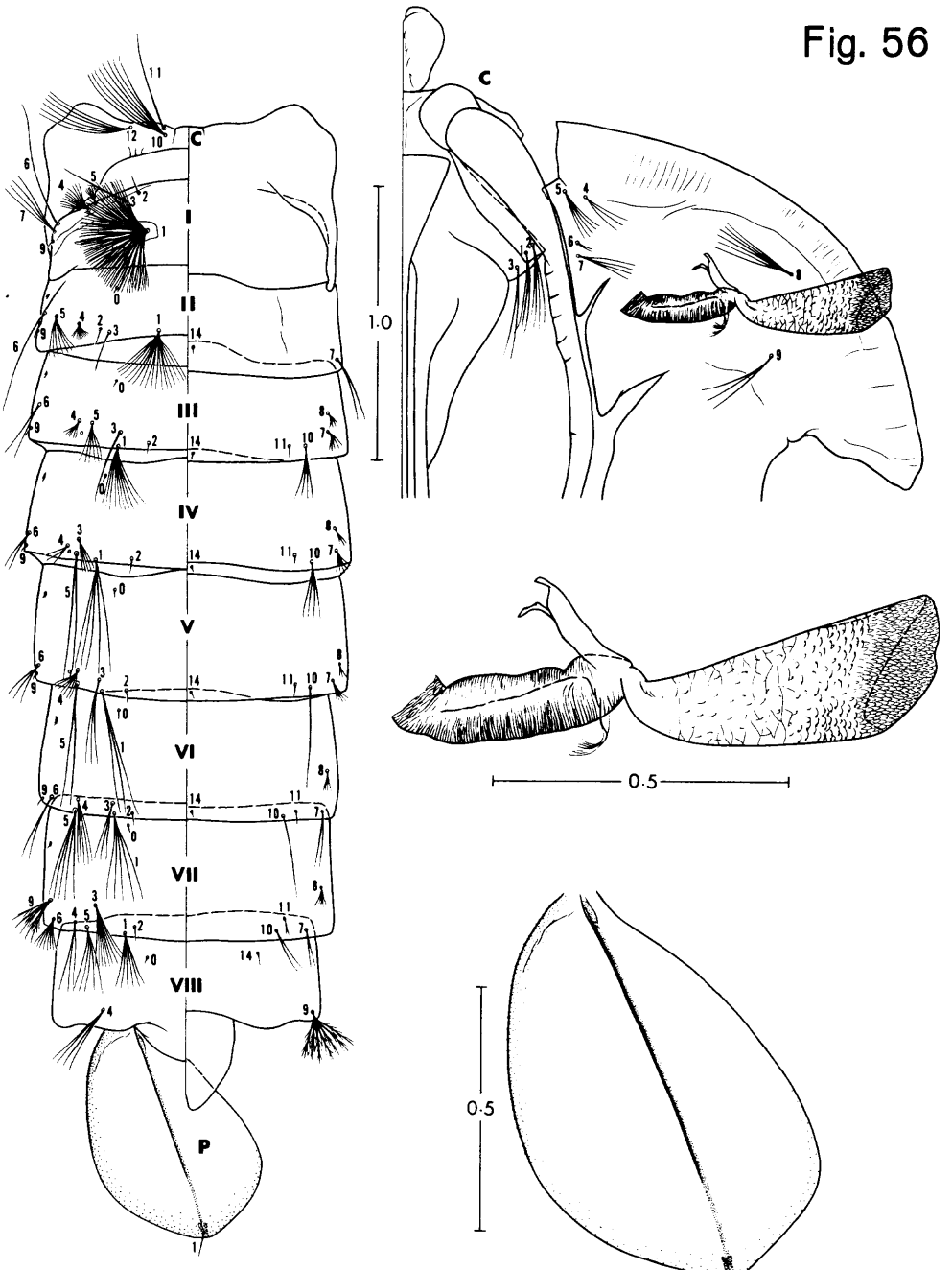


PHILIPPINES

pampangensis

sonobe

Fig. 56

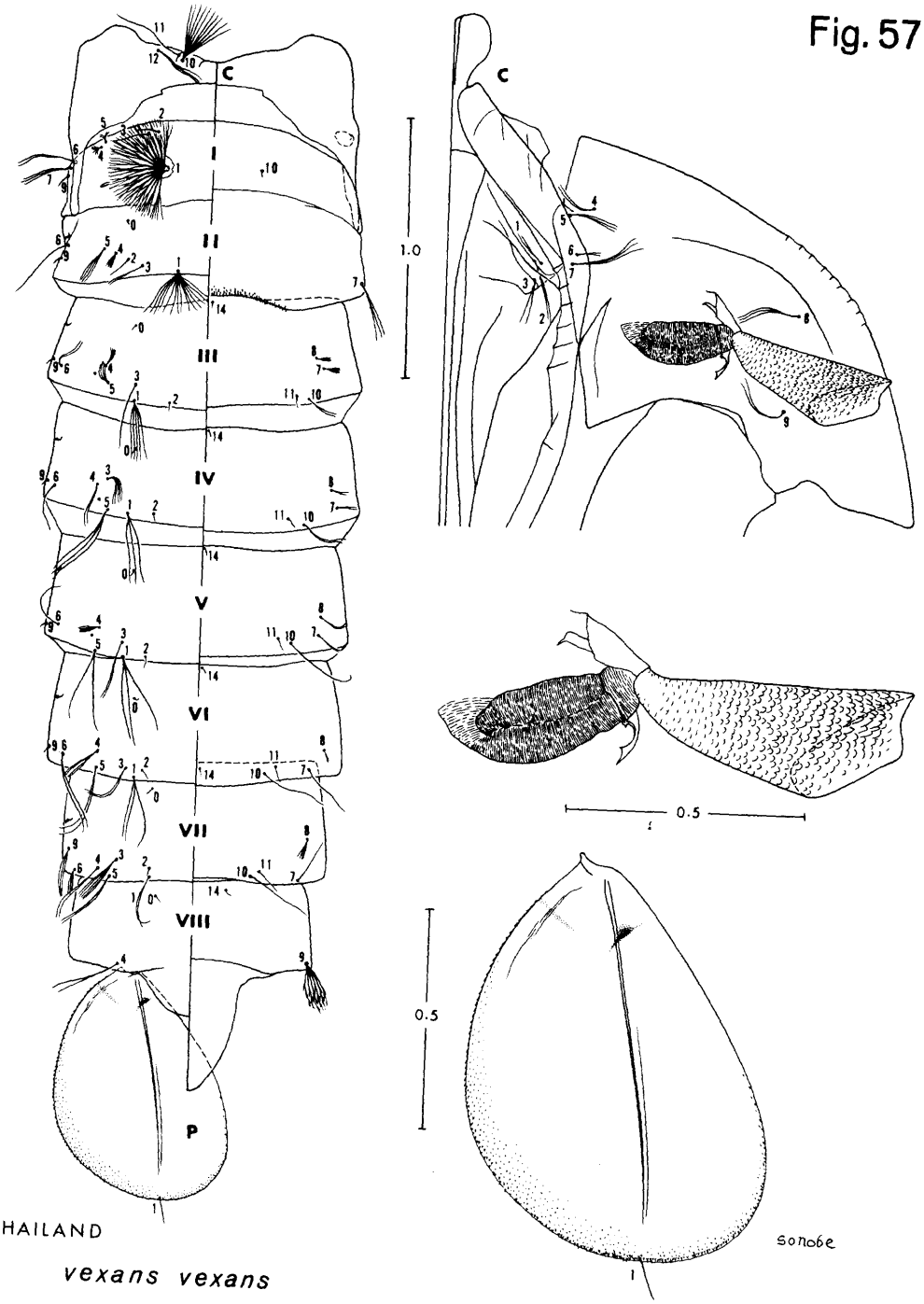


INDIA

pipersalatus

M. Misaki

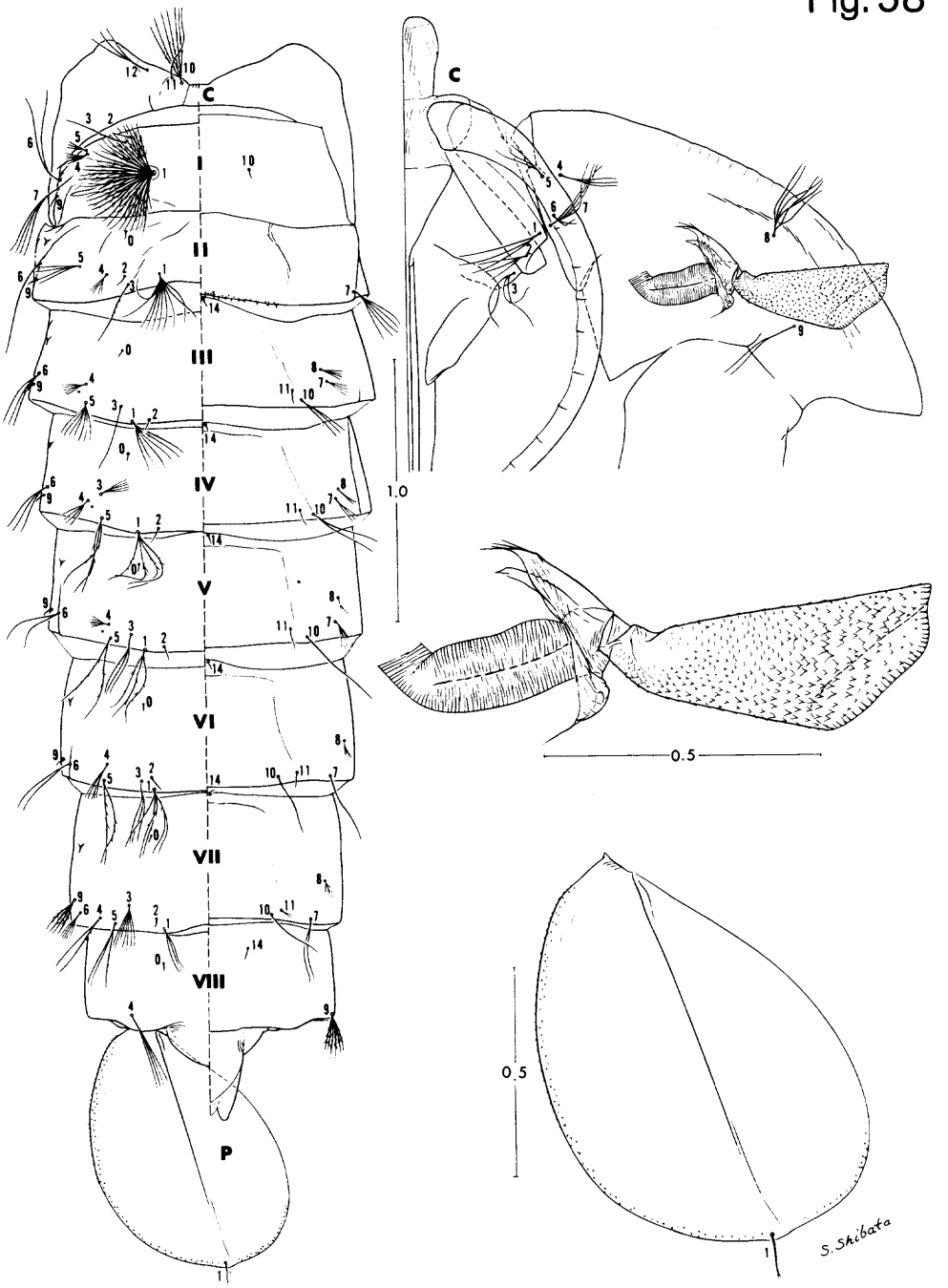
Fig. 57



THAILAND

vexans vexans

Fig. 58



OKINAWA

vexans nipponii

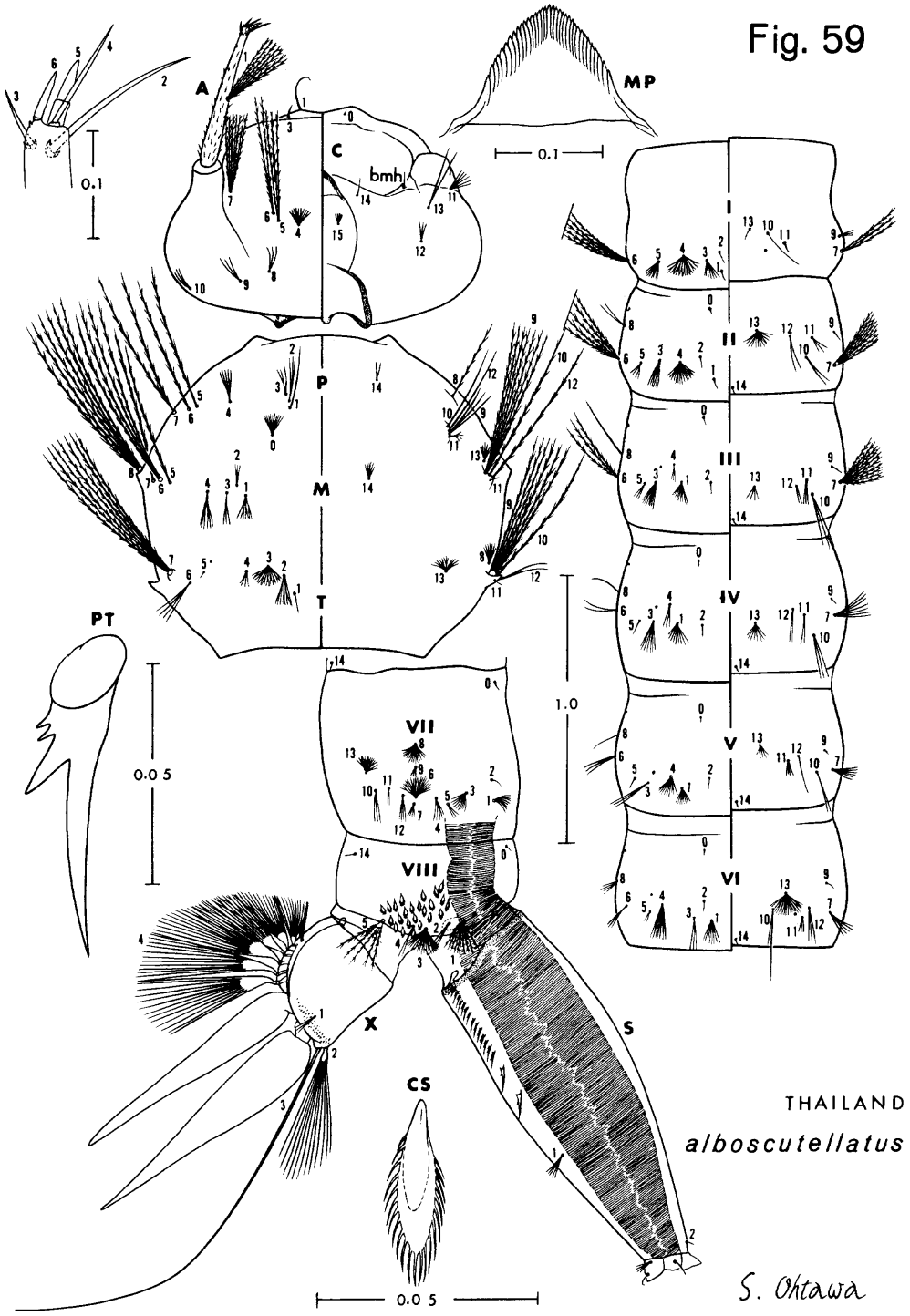


Fig. 59
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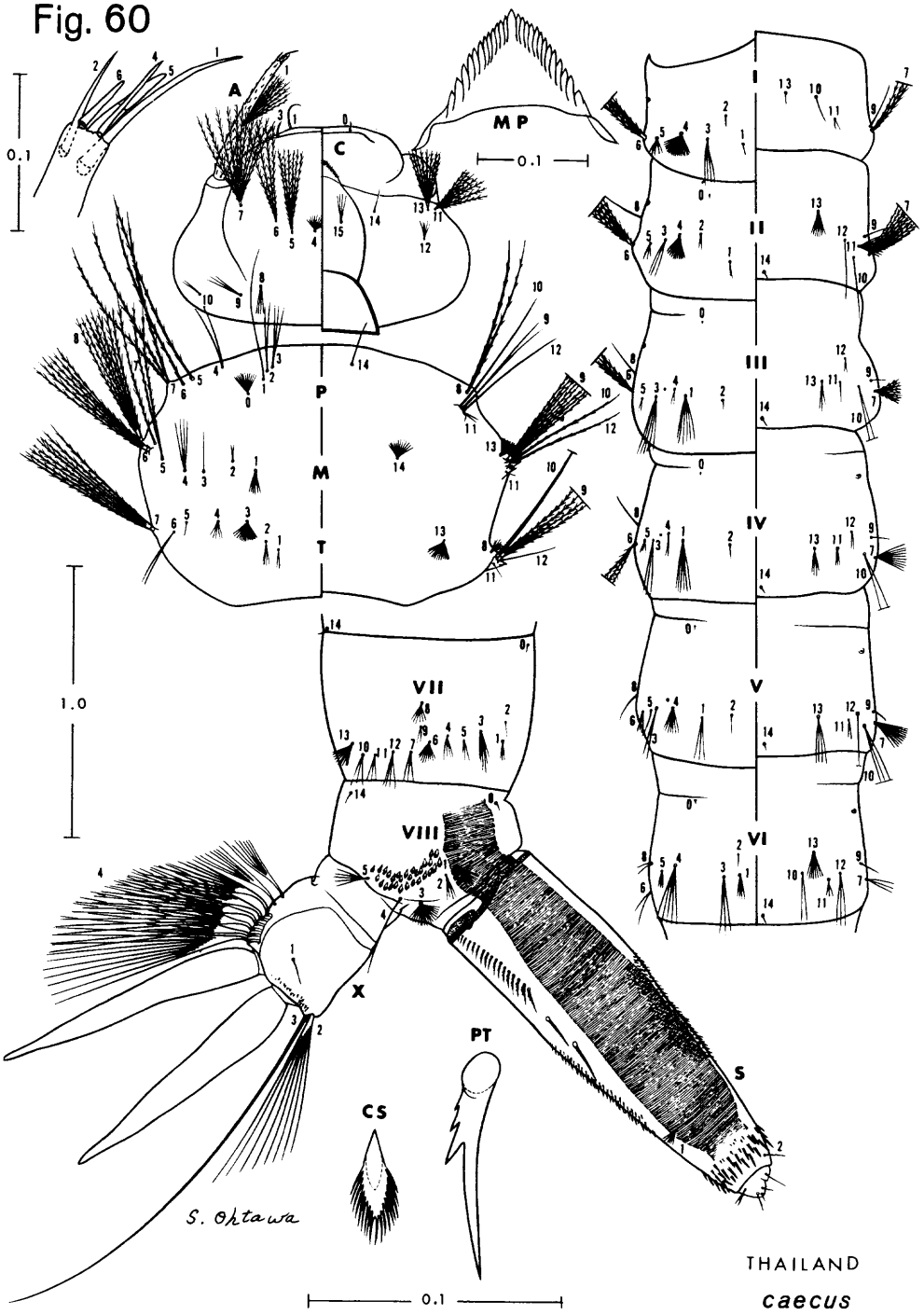
THAILAND
alboscutellatus
S. Ohtawa

Fig. 60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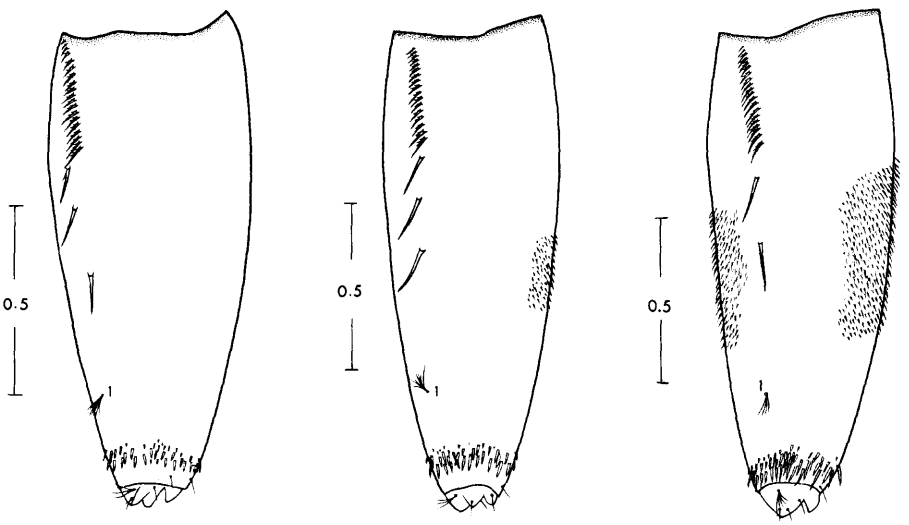
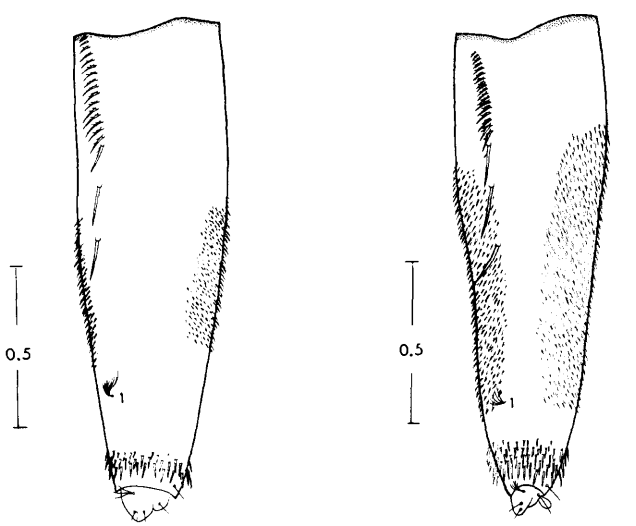
1.0
S. Ohtawa
THAILAND
caecus

Fig.61



variations of siphon

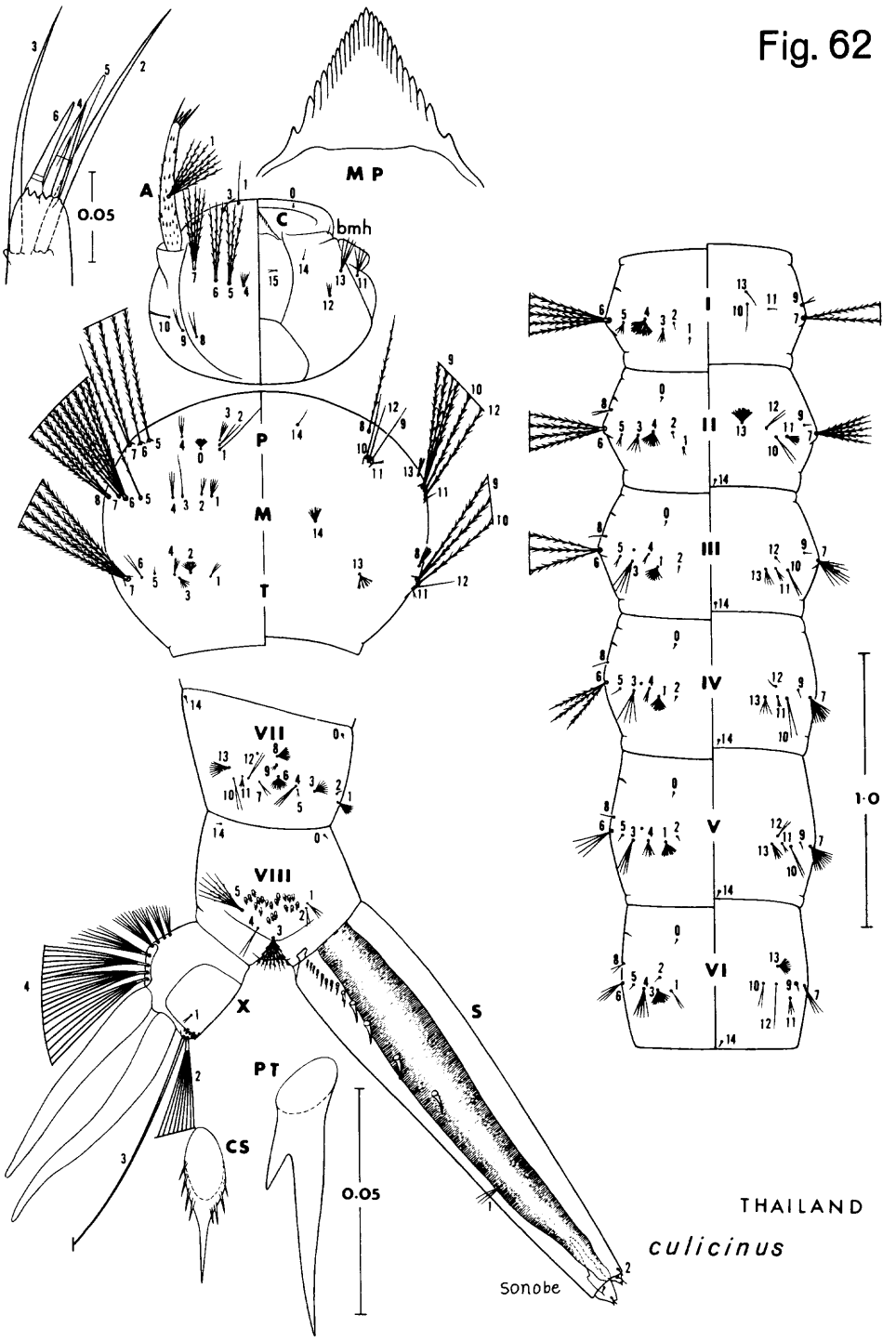


THAILAND

caecus

S. Ohtawa

Fig. 62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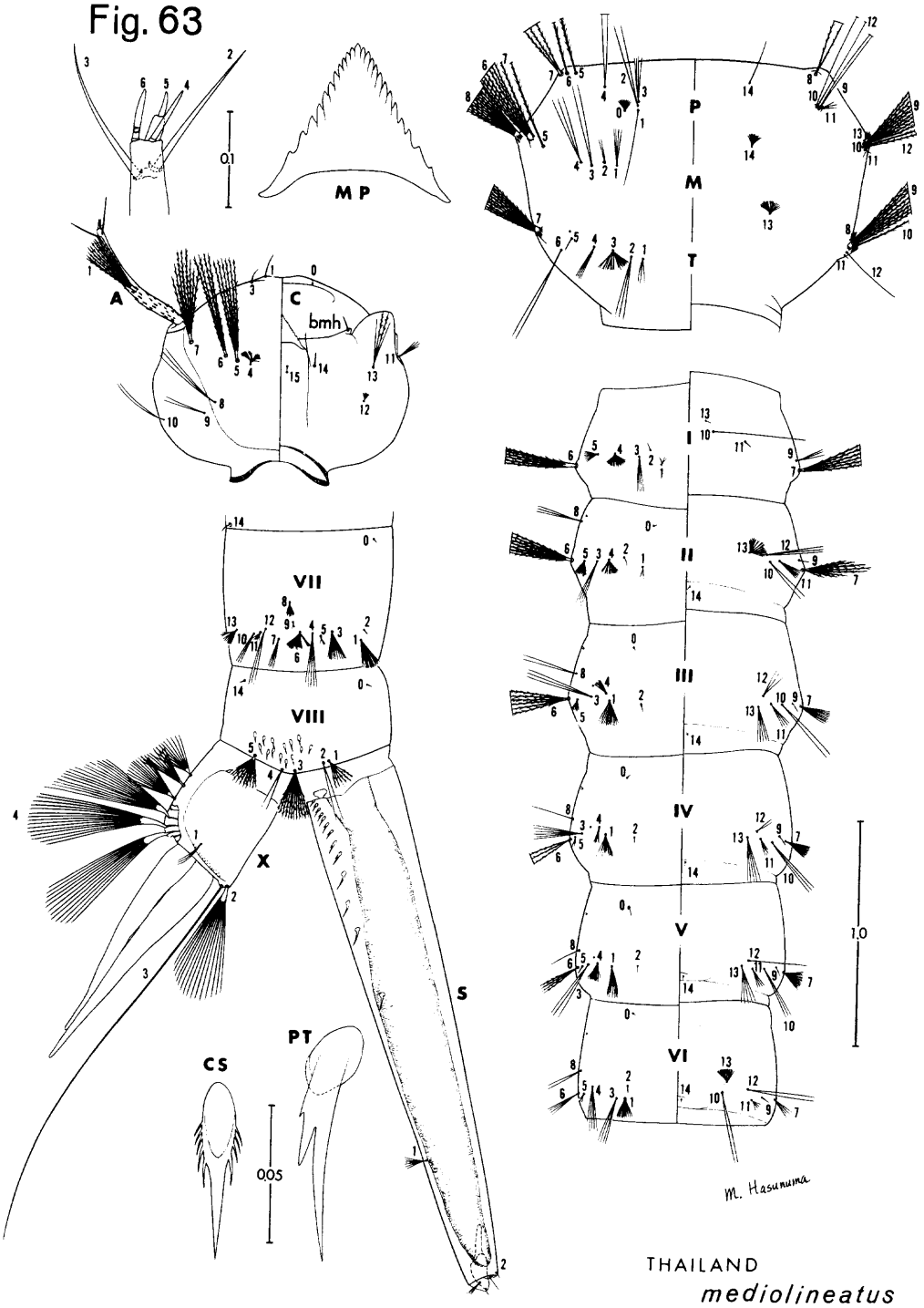
THAILAND
culicinus
Sonobe

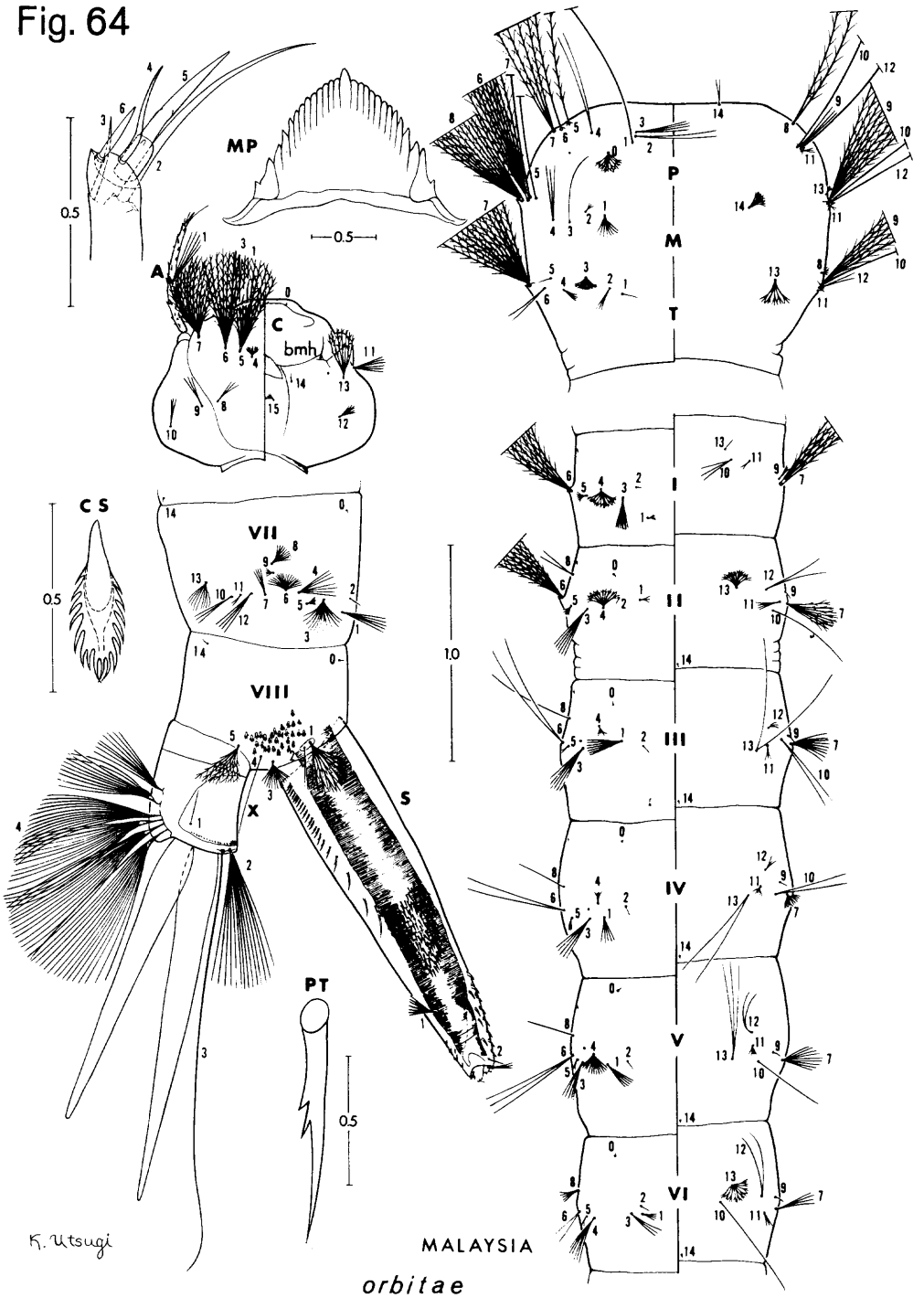
Fig. 63



THAILAND

mediolineatus

Fig. 64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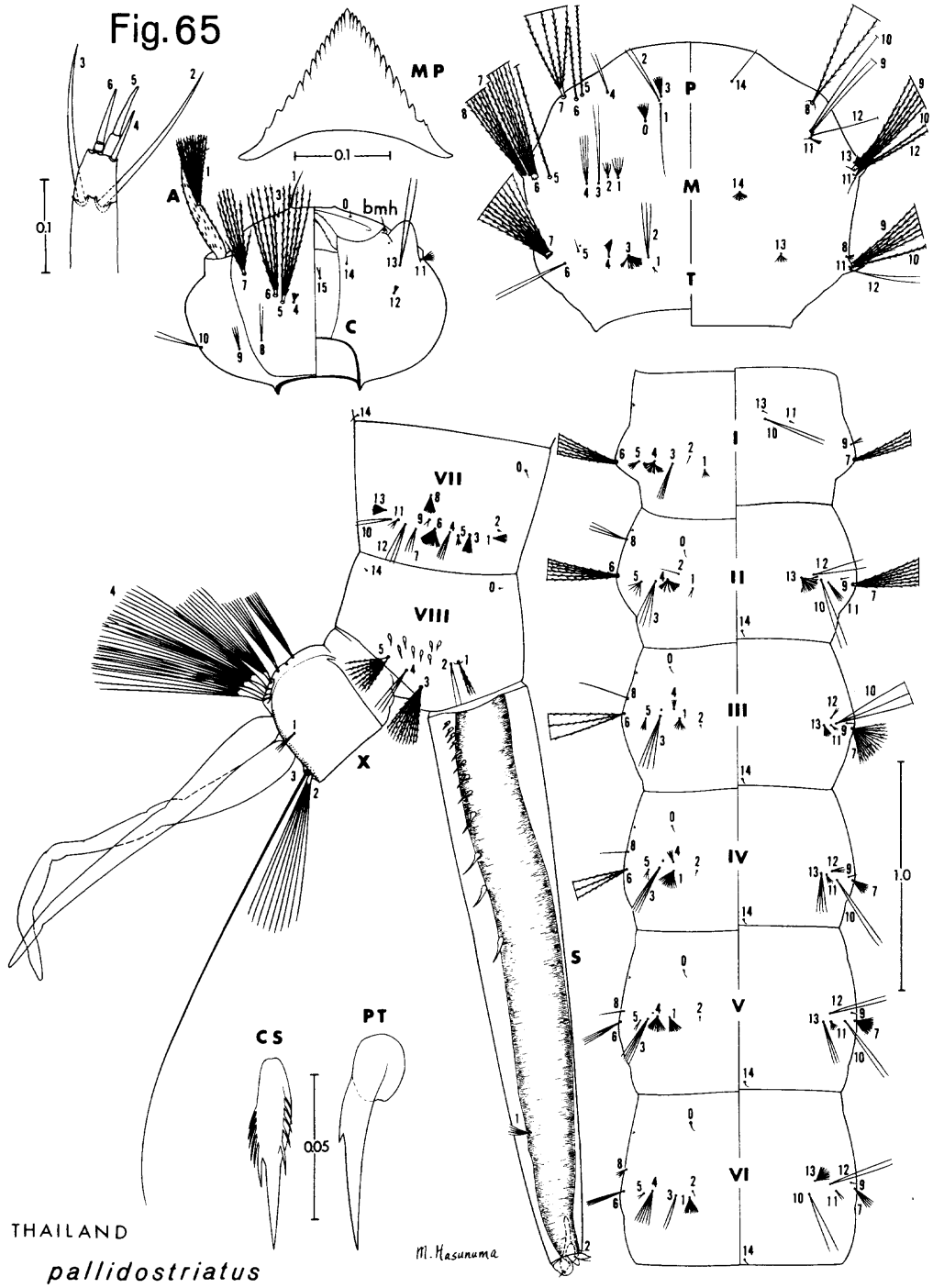
K. Utsugi
MALAYSIA
orbitae

Fig. 65



THAILAND

pallidostriatus

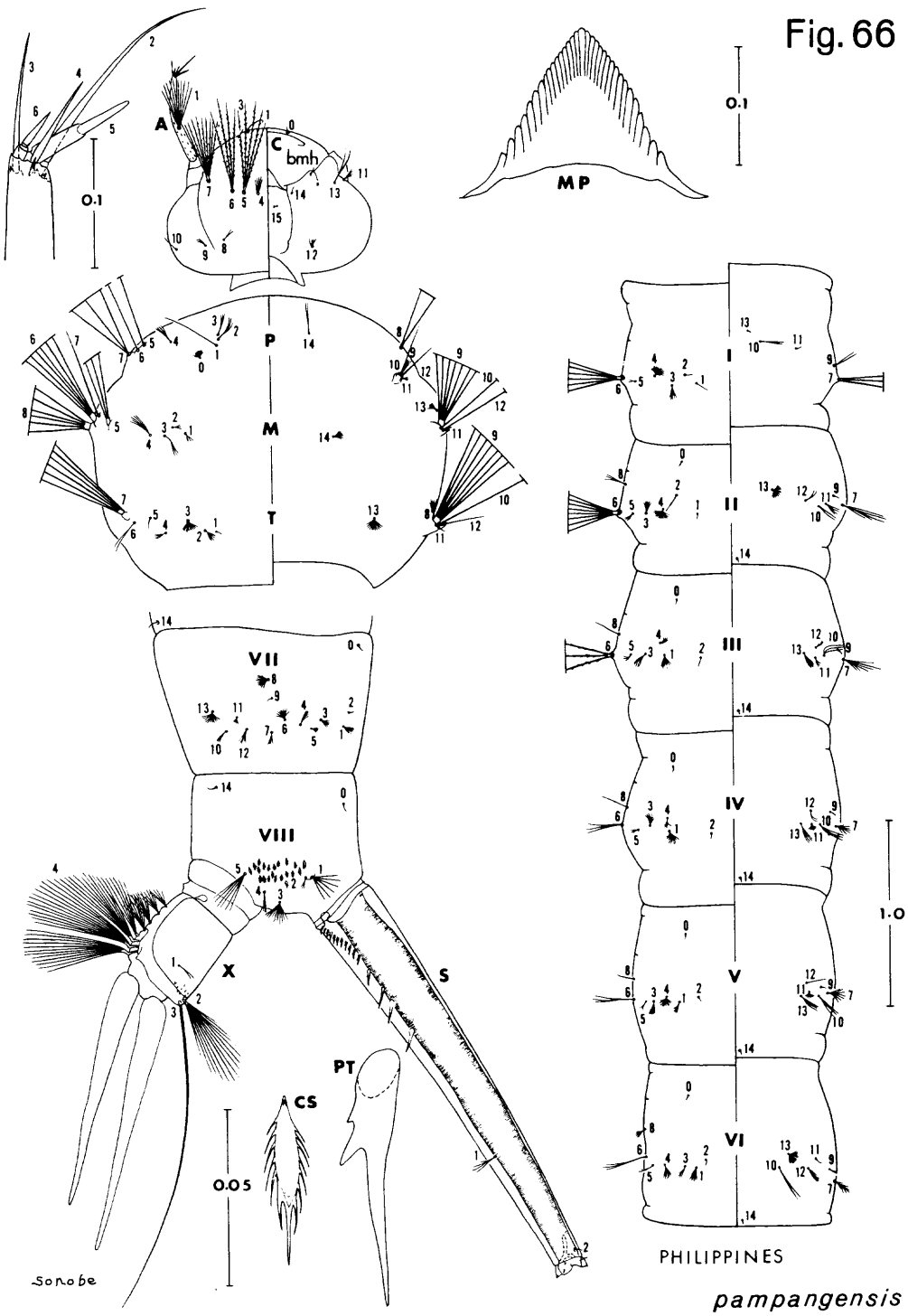


Fig. 66
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VII
VIII
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PT
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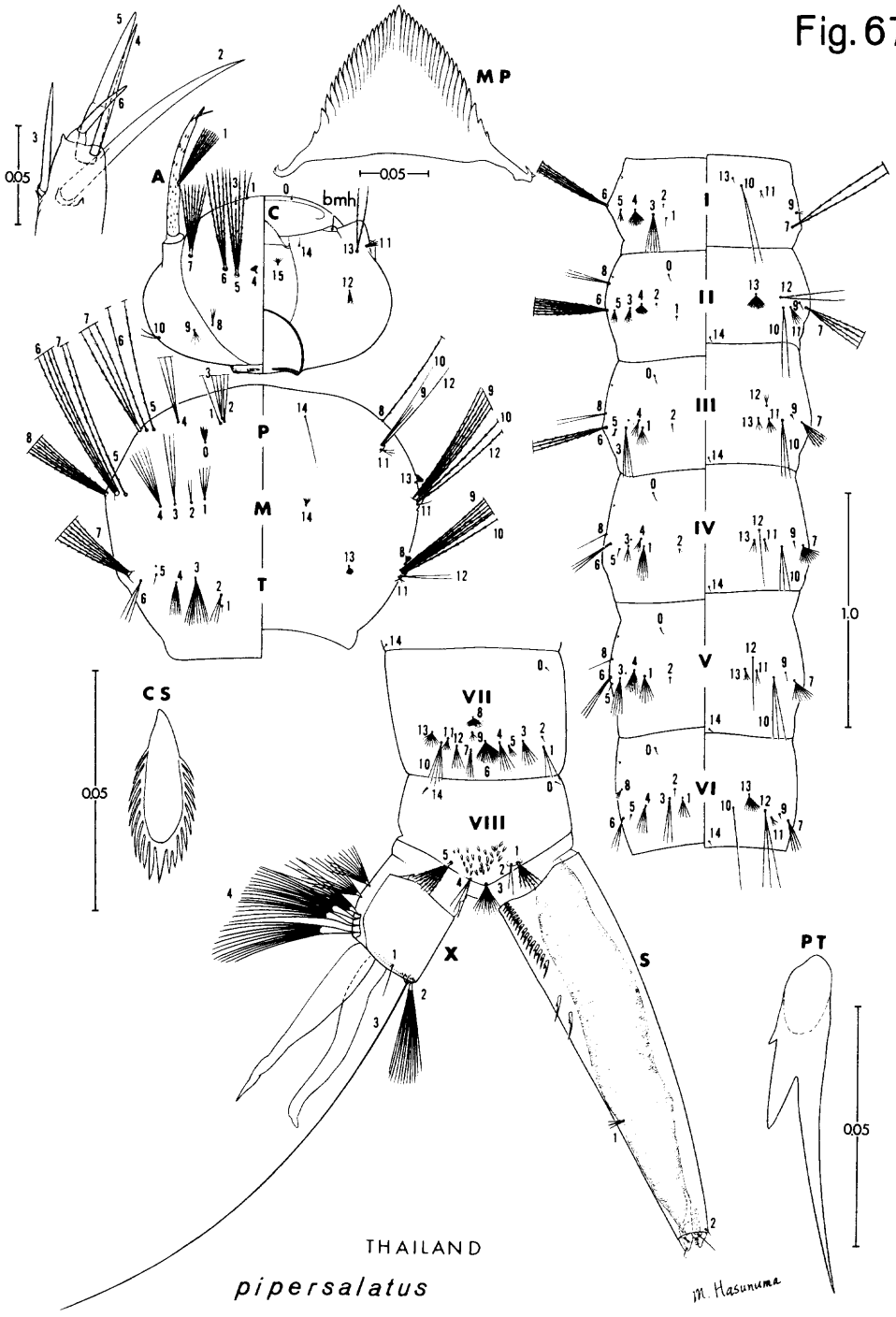
1.0
Sonobe
PHILIPPINES
pampangensis

Fig. 67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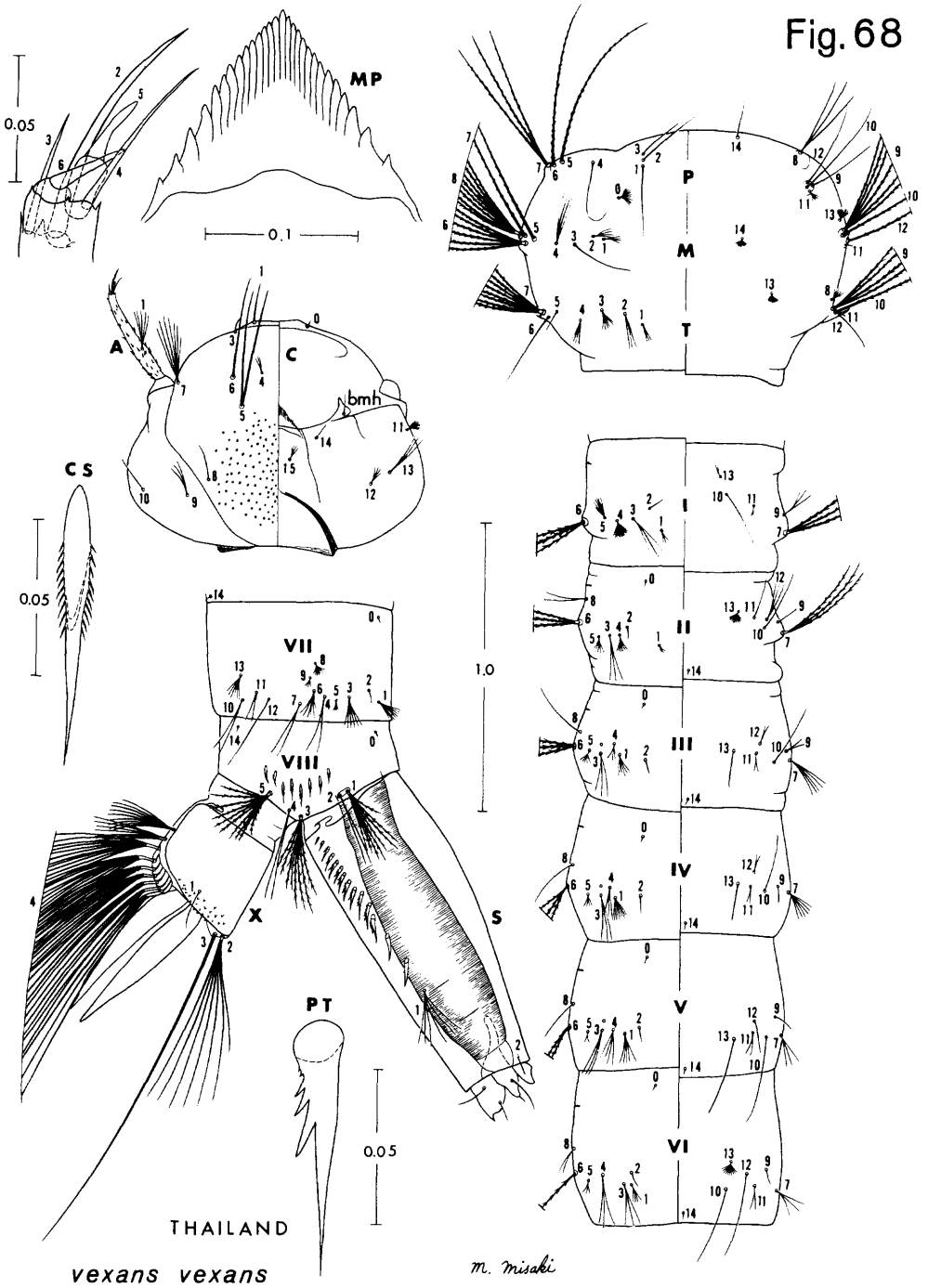
THAILAND
pipersalatus
M. Hasunuma

Fig. 68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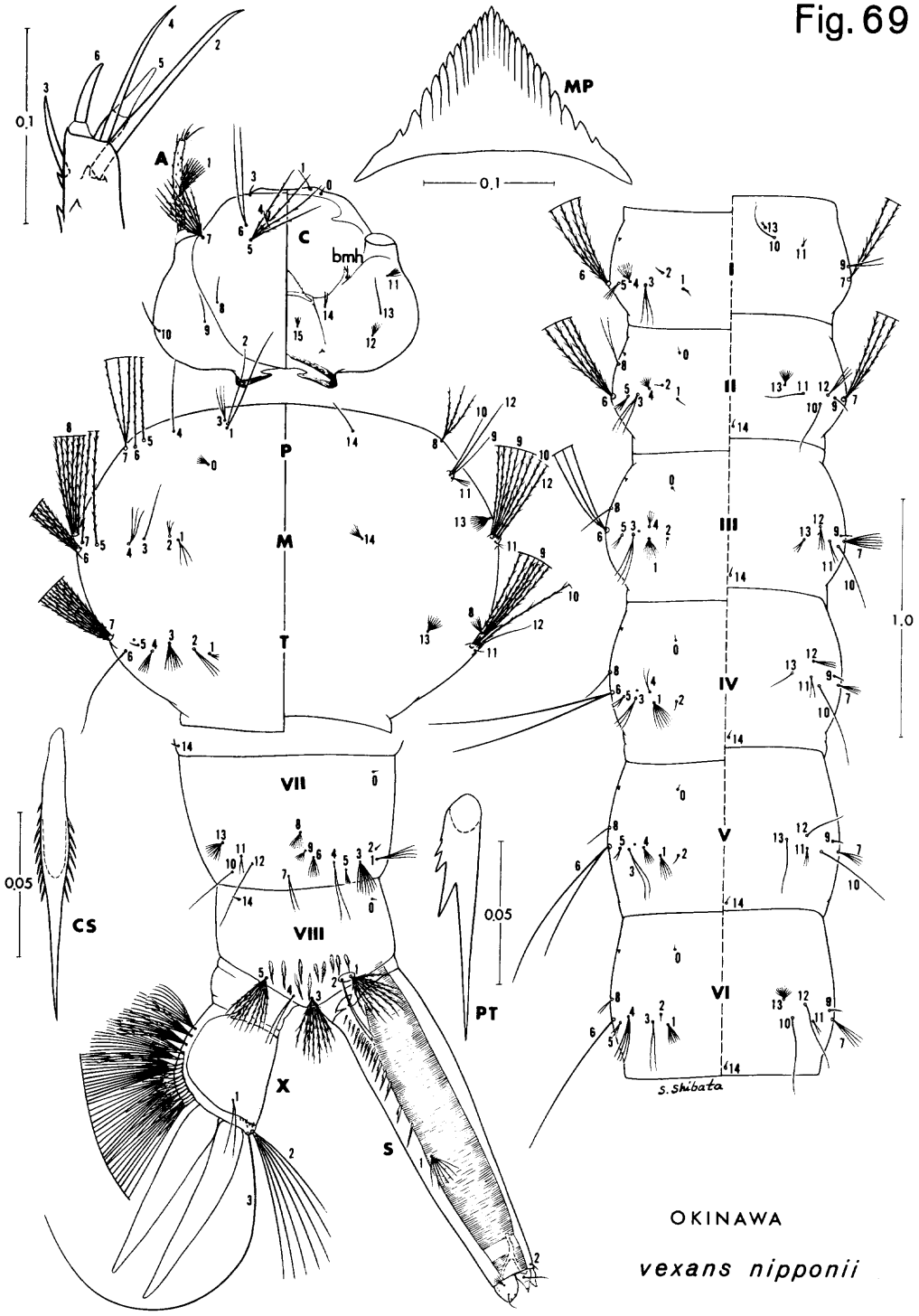
VI
m. misaki

Fig. 69

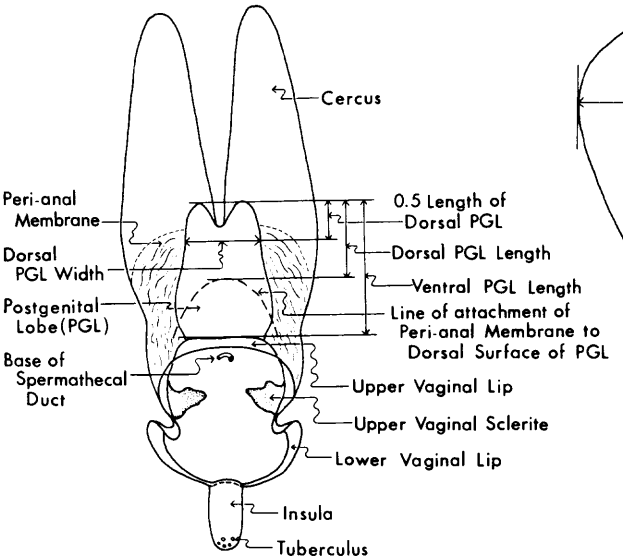


OKINAWA

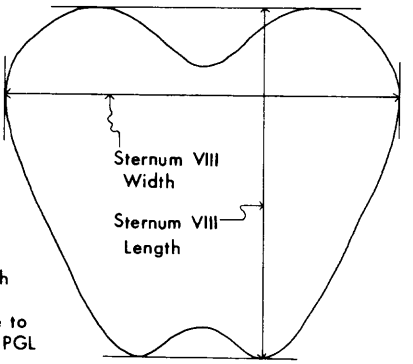
vexans nipponii

MORPHOLOGY OF FEMALE GENITALIA

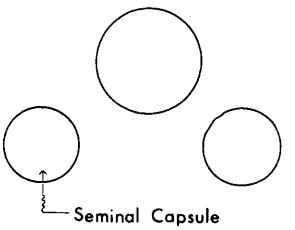
Fig. 70



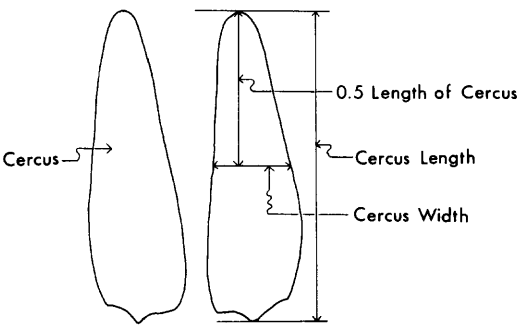
VENTRAL



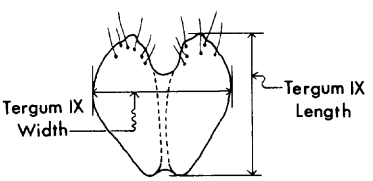
Sternum VIII
VENTRAL



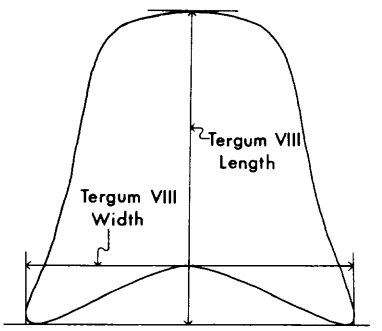
LATERAL



DORSAL



Tergum IX
DORSAL



Tergum VIII
DORSAL

INDEX

Valid names are set in roman type, synonyms are italicized. The italicized pages are those which begin the primary treatment of the taxon. Numbers in parenthesis refer to the figures illustrating the species in question.

Some specimens of *orbitae* in the type series, located in the British Museum (Natural History), bear labels with the following two unpublished names:

alboscutellata var. annul 48
trifeliat 49